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THE LONDON NATURALIST

The journal of the
LONDON NATURAL HISTORY SOCIETY

No 70

Published 1991
Price £4.00

LONDON NATURAL HISTORY SOCIETY

The Society welcomes new members, both beginners and experts. Its Area lies within a 20-mile (32 km) radius of St Paul's Cathedral and here most of its activities take place. Although much covered with bricks and mortar, it is an exciting region with an astonishing variety of flora and fauna. The Society comprises sections whose meetings are open to all members without formality. For those interested in arachnology, archaeology, botany, conchology, conservation, ecology, entomology, geology, herpetology, mammalogy, ornithology, palaeontology or rambling, there is a Section ready to help.

Publications

The London Naturalist, published annually, contains papers on the natural history and archaeology of the London Area, including records of plants and animals.

The *London Bird Report*, also published annually, contains the bird records for the London Area for each year, as well as papers on various aspects of ornithology.

Bulletins of news items, including the Society's *Newsletter* and the *Ornithological Bulletin*, are sent to members throughout the year.

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These are held in most weeks throughout the year, with lectures, discussions, colour slides and films on all aspects of natural history.

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The Membership Secretary, L.N.H.S., P. C. Holland,
Flat 9, Pinewood Court, 23 Clarence Avenue,
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THE LONDON NATURALIST

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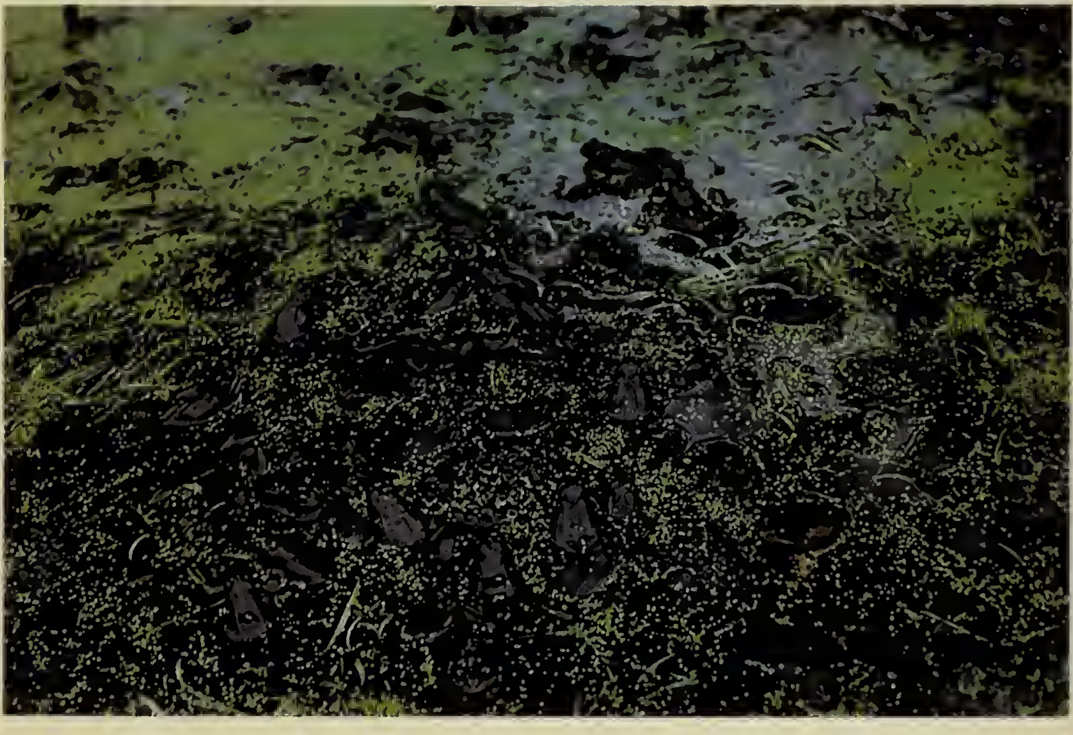

Top. Common frog *Rana temporaria*. Springtime breeding group in pond with duckweed. *Photo: Nigel Blake*

Bottom. Common lizard *Lacerta vivipara*, female above, male below. Northpole Junction, Hammersmith, west London. *Photo: Nigel Blake*

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The journal of the
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No. 70

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†Deceased February 1991. An obituary appears on p. 163.

‡Deceased June 1991. An obituary will be published in the next issue.

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Records may be sent to the appropriate recorder or to Colin Plant who will distribute to each recorder the relevant data from a mixed set of records.

Requests for information should be made to the appropriate recorder.

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Report of the Society for 1990

(Presented at the Annual General Meeting on 12 December, 1990)

Looking back over the year the impression is of a stable Society pleasurably and knowledgeably going about its affairs, issuing publications, holding meetings, stimulating naturalists of all levels of experience to come together in a common interest. Two very encouraging indicators of the health of the Society are its continuing and very apparent activity in many fields and the creditable total of newcomers who have taken note of what the Society has to offer and decided to join. We have been pleased to welcome 114 new members during the 1989/90 membership year, which ended on 30 September. Already, in the first few months of the new year, over 50 more members have been enrolled. We welcome them all, as we welcomed those who joined earlier, and hope that they are already enjoying in full measure the benefits of membership.

The Annual General Meetings of each of the Sections of the Society have already been held and those who were able to attend them will not be in any doubt about the benefits of membership. It is customary for each Section to put before members a record of its achievements in the year and the summary of sectional activity which follows draws on the Reports of the Sections.

The Botany Section has again provided a varied programme of indoor and field meetings. The Section's informal indoor meetings, in particular, have been very well attended and there is evidently a desire by many for practical instruction.

The emphasis of the Ecology and Entomology Section's full and varied programme of indoor and often related field meetings, which in the past has covered a wide geographical spread, was focused this year on the natural history of the London Area. The section also maintained a regular presence at its survey site on Bookham Common in Surrey, meeting there on the second Sunday of each month throughout the year. In addition, team members acted as course leaders for a series of six informal one-day courses on the Common, covering a wide variety of plant and animal groups. Publication of results by the Section's recorders and by the Bookham Survey Team are a regular and continuing part of the Section's contribution to the corporate life of the Society.

The Geology Section held a comprehensive and varied programme of visits and lectures during the year. It has, however, recently experienced serious difficulties organising field meetings due to the prohibitive costs of coach trips for small parties, leading to the unprecedented cancellation of three field meetings since July. A new formula for field meetings is being sought which it is hoped will allow the interesting and valuable work of the Section to continue.

A major feature of the Ornithology Section's fieldwork during the year was the third year of the breeding bird atlas. Coverage is still not complete and at least one more year of fieldwork will be required. The only individual species survey this year was a Wildfowl and Wetlands Trust survey of mute swans. Frequent lectures from well-known speakers were supplemented by trips to many sites of ornithological interest both in London and further afield. A new, annotated list of the birds of the London Area is being contemplated; in the meantime, a simple checklist will be included in the forthcoming *London Bird Report*.

The Ramblers and Archaeology Section continues to provide a balanced programme divided fairly equally between general natural history rambles and archaeology outings, with a few exploring the local history of the London Area and its villages.

The South-West Middlesex Section continued to provide members in that part of London with a varied range of indoor meetings and field meetings; a mail-shot of local members failed to increase participation, reflecting an apparent problem other sections are facing in finding officers and securing good attendances at many meetings.

The start of the year saw the launch of a new membership leaflet and plans are already in train for a cut-down version for use in bulk mailings and with a display stand at exhibitions. Sales of the Society's journals and books have benefited from increased publicity and special offers. A few recent issues are now in short supply.

It is with regret that we record the deaths of the following members: Richard F. Allen, Miss M. E. Bennett, Dr Geoffrey Beven, John Chipperfield, Miss Hilda Franks, Philip Greenwood, J. E. Harvey, C. E. Luce, John Sand and Vera Willis; and a former member, Peter Grant. Geoffrey Beven was an Honorary Vice-President and a prime mover of the long-running Bookham Common Survey; a full appreciation of his life and work appeared in this year's *London Naturalist* (**69**: 147-155). John Chipperfield was an active member of the Ornithology Section; he left the Society a large and valuable collection of natural history books and other items, including a stamp collection of note. Hilda Franks was the Society's Schools Liaison Officer for many years. John Sand was Treasurer from 1982 to 1987 and, latterly, Chairman of the Society's Administration and Finance Committee. Peter Grant was one of the Ornithology Section's Recorders and edited the *London Bird Report* for the years 1969 to 1971 before going on to become one of the country's most highly respected experts on bird identification.

Membership intake this year, at 114, was up a little on the figure for the previous year. The breakdown of the number of members at the end of September 1989 and 1990 was as follows:

	1989	*1990*
Ordinary	882	808
Family	115	105
Junior	11	10
Senior	126	125
Honorary	15	12
Life	8	8
Affiliated	15	15
Total	*1,172*	*1,083*

Your Council has taken note of the slight drop in membership which these figures reveal. It is unlikely that a broadly-based society such as ours could be untouched by the economic and social trends of the day, but the latest enrolment figures are encouraging and we have reason to hope that a rapid recovery is in train. An annual subscription rate unchanged since 1988 is the practical expression of a conviction that membership of the L.N.H.S. should be within the reach of all.

Our thanks go to all officers and sectional committees who work so hard for the Society. Thanks go also to Imperial College for allowing us the use of their rooms and to Mrs Czigány and her staff for the custody of the Society's library.

Treasurer's Notes on the Annual Accounts for 1989/90

(Presented at the Annual General Meeting, 12 December, 1990. See also pp. 174-5)

In the financial year ended 30 June 1990, the Society's accounts show a surplus of £5,265; this was after taking a provision for the diminution in the value of certain investments (where the current market value is less than the book value). This compares with a surplus of £397 in 1988/89.

Total income was £34,560 compared with £26,944 in 1988/89, an increase of 28%. This rise was more than accounted for by a marked increase in income from investments, both dividends and interest and profit from the sale of investments. The latter cannot be relied on year in, year out, as it depends on the state of the markets and on how far National Westminster Bank, who manages our investments, turns over our portfolio. Income from members fell slightly despite a rise in tax recovered on covenanted subscriptions, which reflected the higher subscription rate two years ago.

The rise in income was coupled with a fall in expenditure of 6%, from £27,871 in 1988/89 to £26,158 in 1989/90. Meetings costs, sectional and general expenditure fell by £1,227, very largely because of reduced costs of depreciation as the remaining 10% of the computer expenditure was written off. The cost of printing the Society's publications also fell, partly because of shorter journals and partly because of technological improvements in the production of the *London Bird Report*. The increase in publicity expenditure partly reflects the cost of the new membership leaflet.

Society Grants

The Society sets aside a small amount each year to assist conservation work, the establishment or maintenance of nature reserves and scientific investigation in the London Area. Applications for grants and loans are considered by the Administration and Finance Committee: enquiries should be addressed to its Secretary. Papers reporting results of research supported in this way must be submitted for publication in the Society's journals.

Book Review

In Search of Birds. Their Haunts and Habitats. By Jim Flegg, illustrated by Norman Arlott. Blandford (Cassell), London. 1991 edition. 152 pp. £8.95, paperback. ISBN 0-7137-2247-9.

This book was first published in 1983 and, although I did not read that edition, I am glad to have had the opportunity of reading it now. I have no idea to what extent the new text has been enlarged or altered, but the section on further reading contains eight titles from 1983 to 1988, bringing the list to 43. The author has described in a very easy and individual way good realistic approaches to birdwatching in habitats ranging from estuaries, wetlands, farmland, woods, mountains and moors and coasts and islands. Rarities are allowed a chapter, but thankfully twitching is not mentioned. 'Into Europe' dwells mainly on the species which are attractive to British birdwatchers – those that are on the British list, but which we don't see often enough, like hoopoe, Sabine's gull, bee-eater, etc. The last chapter is 'Globe Trotting' – and why not? Most of us have at some time or other been farther afield than Europe and added greatly to our life list with tropical and subtropical species, as well as the more numerous counterparts of familiar British species.

The black-and-white drawings by Norman Arlott are attractive and well chosen, whilst the 16 half-page colour photographs of habitats are superbly sharp, although we are not told who the photographer is. In the text we have a few errors like greater black-backed gull (twice on one page) and Maramora's warbler, although both are correct in the index, and in the Appendix Ornithologische is spelt wrongly, whilst Alfred Russel Wallace has the frequent 'll' to his second name. I notice that only a handful of the localities in the 'Globe Trotting' chapter are in the index. Being published in March 1991 it might have been possible to have given the new Thetford address of the B.T.O. and to have updated the Nature Conservancy Council.

I recommend this book as an ideal Christmas present to be read before wrapping it.

K. H. Hyatt

Britain's Longest-Running Biological Survey

By C. B. Ashby*

(Presidential Address delivered at the Annual General Meeting on 12 December, 1990)

When we met at this time last year to consider the affairs of the Society we took a wide-ranging look at the achievements over the last 40 years in almost every aspect of the natural history of the London recording area. This evening I shall invite you to focus in a little more detail on one particular field of endeavour: a co-operative enquiry which has earned the Society recognition not only in this country but abroad, and has occupied successive teams of field naturalists summer and winter, year in, year out since 1942; and has filled hundreds of pages in *The London Naturalist* and elsewhere with the results of close observation, regular censusing, the monitoring of the ever-changing vegetation, and the building-up of a comprehensive picture of the fauna and flora of a defined area unique in Britain, perhaps anywhere. I refer, of course, to the Society's ecological and biological Survey of Bookham Common in Surrey.

As the current spokesman for the Survey, I am bound to say that the mantle worn by such innovators as Leonard Parmenter, Cyril Castell and, more recently, Ella Hillman and Geoffrey Beven, rests uneasily upon my shoulders. But I am greatly encouraged by the knowledge that the present Survey Team, with whose names you are I am sure familiar from their contributions to the annual Progress Reports, are fine naturalists all, and worthy successors to those who shouldered the responsibilities, enjoyed the rewards and suffered the disappointments of earlier years. Some, it should be noted, have devoted more years and more sustained effort to the survey than I myself have been able to contribute; and my very considerable debt to them for their advice, experience and encouragement I gratefully acknowledge.

I suspect there will be those among my audience who are by now wondering what is the point of it all. Why continue it? Surely, after nearly 50 years everything that is to be known about Bookham Common is known by now. Bookham is a National Trust Common, a Site of Special Scientific Interest, administered by a local management committee. Had they called in a team of professional ecologists and consultants, as English Heritage has recently done for Hampstead Heath, a comprehensive survey would have been undertaken with the greatest perception and precision, with perhaps every tree numbered and every feature noted on a set of large-scale, special-purpose maps and plans: all in record time and no doubt beautifully presented. The ecologists would have drawn their fee, shut up shop and moved on. Amateur naturalists may take a little longer – 50 years perhaps; their reports and plans a little more modestly presented, their lists and catalogues a little more slowly formulated, their anticipation of the effects of management a little more cautious and hesitant. But what satisfaction they will have had from working together in the field as a team; of submitting to the discipline of making a regular commitment; of coming to realise that the more they discover about a subject, or an area, a group, even a single species, the more questions come unbidden into their thoughts.

The year 1991 will be the fiftieth year of the Survey. Dr Geoffrey Beven, in his Presidential Address on 7 December, 1967 reviewed the first 25 years. The transcript which subsequently appeared in No. 47 of *The London Naturalist* remains essential reading and is most usefully supplemented by a full bibliography of the many papers and progress reports which had appeared in the *L.N.* and elsewhere up to that time. The *L.N.* has continued to publish the results of the Survey in every year since, so that by now there is a great volume

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*31 Tudor Close, Cheam, Sutton, Surrey SM3 8QT.

of un-indexed material in its pages. Believing as I do that this hard-won information contains much that will be of interest to you, I will endeavour to be your guide to as much of this second quarter-century of the Survey as time will allow.

The Common in earliest times was doubtless covered by dense, mature oakwood, and the grasslands on the lower areas which we now call the plains developed initially from the cutting and clearing by ancient settlers. From the accounts by C. P. Castell, J. H. Harvey and W. H. Spreadbury, quoted and summarised very clearly by Beven, it is evident that grazing by domestic stock was commonly practised over a long period, decreasing in the twenties and thirties of the present century, ceasing finally in 1949. The continuous grazing and trampling by horses, cattle and sheep, together with further grazing by domestic geese and a persistent rabbit population, effectively prevented the regeneration on the plains of bracken and most woody plants.

Following removal of the last few cows from the Common, it soon became apparent that a programme of management would be needed if the steady development, not only of grasses, but of a variety of invasive shrubs and trees was to be held in check. A short quotation from Beven's 1967 review provides clear evidence of the rapidity of the changes which were taking place. 'Between 1952 and 1966 the total number of hawthorn plants increased by 50% in one study area and 20% in another, while the hawthorn scrub canopy cover increased by five times in one area and by ten times in another.' This period included the years 1954-1956, when grazing by rabbits at first reduced, then ceased, due to the almost total extermination of rabbits on the Common by myxomatosis. Oak canopy cover in selected study areas meanwhile had increased by 12 times. By 1963 The National Trust was employing machines to cut down and drag out trees and scrub from the plains, and by 1967 some 12 out of 35 acres of Central Plain had been cleared.

The 22 aerial photographs commissioned by the Survey, with the assistance of David Martin, this summer reinforce impressions obtained from the ground and show that, notwithstanding an active programme of management, the progressions of grassland to scrub and scrub to woodland have transformed all but a small proportion, perhaps 10%, of the plains. Castell's photograph in 1943, reproduced in *L.N.* **35,** Figure 1, provides the evidence.

A subsequent photograph, taken from the air in 1949, the last year of grazing by cattle, shows nearly a third of the Common as grassland. This extended from the railway line in the south to the encircling farmlands at Hundred Pound Bridge in the north, together with two sizeable intrusions into the oakwoods east of Common Road. One of these was Eastern Plain, described as recently as 1975 by Ella Hillman (*L.N.* **55:** 19) as a pleasant and accessible grassland following control of bracken. Central, Bayfield, Isle of Wight and Western Plains together account for 96 acres and are described for 1968 by W. D. Melluish in *L.N.* **48:** 135-142. The effects of cutting bracken and grass in 1969 and 1970 were the subject of a closely observed ecological study by Hillman and others (*L.N.* **49:** 96, **50:** 101), and a new factor – the appearance of roe-deer in 1968 – was considered. Indeed, one may read in the annual Progress Reports throughout the period an almost blow-by-blow commentary on the contest unceasingly being waged for the survival of a diversified habitat.

The Survey has benefited greatly from the friendly co-operation accorded to the L.N.H.S. team by The National Trust Bookham Commons Committee; and particularly by Mr Ian Swinney, the Trust's Warden for the Common since 1979, in whose garden the Survey hut is situated. The continuous record of the practical aspects of management is brought up to date by Mr Swinney's reports for 1988 and 1989 (*L.N.* **68:** 134-135, **69:** 119-121); and his valuable account of the effects of the great storm of October 1987 (*L.N.* **67:** 147-148). Hundreds of trees, especially the Turkey oak *Quercus cerris*, were 'brought down individually or in twos and threes throughout the wooded areas and on the plains'. A great many mature and intermediate pedunculate oaks *Quercus robur* suffered severe damage to the branches and those which became a threat to public safety were of necessity felled. Informed conservation policy throughout the devastated areas of south-east England has increasingly turned to the concept of leaving fallen trees *in situ* wherever possible, and the provision of a degree of natural dead wood habitat is the policy of the Trust at Bookham. It is of interest to note that Mr Swinney, in his 1989 report, equates one of the chief aims of management, namely the promotion of species diversity through habitat diversity, with an intention to return, at least in some measure, to the environments of antiquity.

An important recent development, again with the expressed aim of habitat diversification, has been The National Trust's decision to resume the grazing by cattle on the Common. Bryan Radcliffe (*L.N.* **69:** 121) has recorded that a boundary fence was erected to enclose 13 acres of Division R on Central Plain, encompassing open grassland, scrub and incipient woodland. In 1989, from 2 July to September, six cows were turned out on the Common, followed by nine from late November. The experiment was repeated this year (1990), and we hear that the farmer is discussing with The National Trust the possibility of extending the fenced area.

Radcliffe's plans for monitoring the changes in the vegetation which will be occasioned are given on page 121 of the recently issued *London Naturalist* **69.** In essence, six botanical study areas, or quadrats, each two metres square have been established in Division R. There is nothing to indicate their presence except a marker post, and the cattle have free access to them. The quadrats have been sited on areas of dissimilar terrain, with no two being nearer to each other than 40 metres, and they will be checked annually and recorded. The hope, indeed the expectation, is that future Progress Reports will endeavour to assess the medium and long-term effects of this interesting return, albeit in small part, to the traditional use of common land (See Figures 1-3).

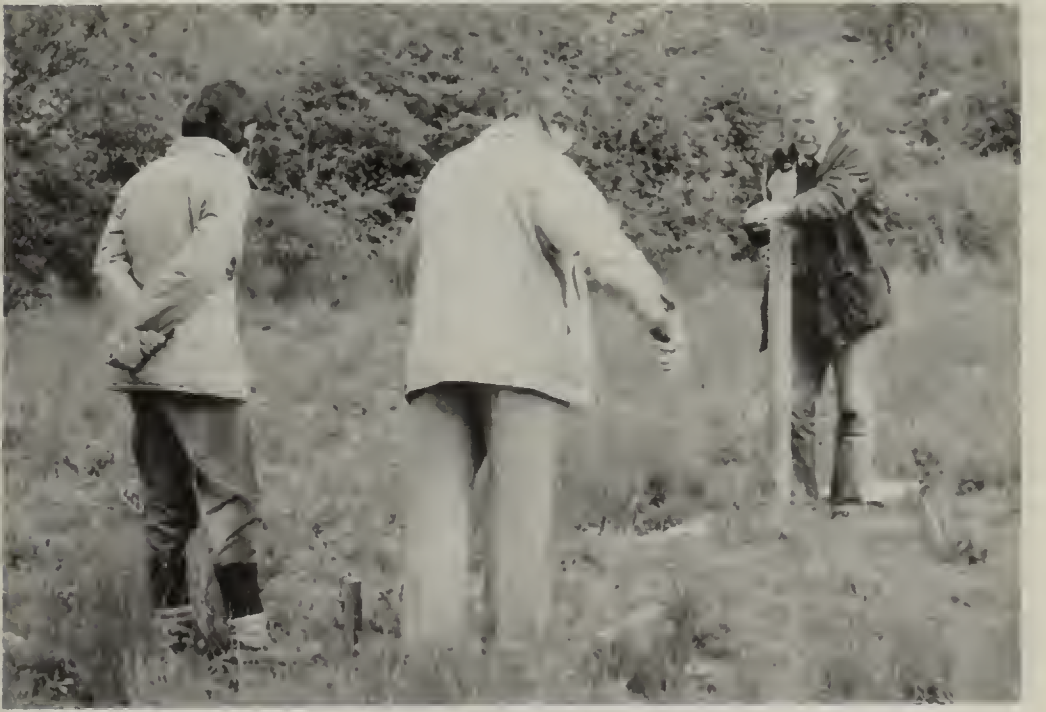

FIG. 1. Marking out a quadrat by taking a compass bearing from the marker post.

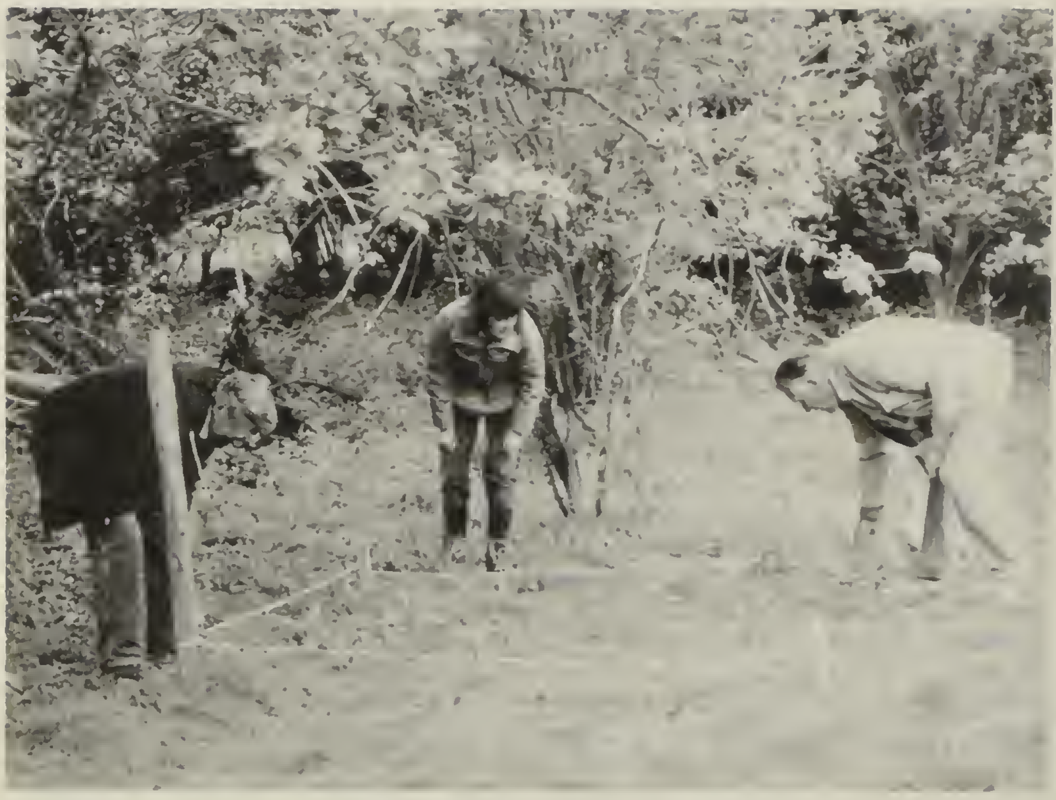

FIG. 2. A marked-out quadrat.

FIG. 3. Identifying the plants within a quadrat.

Many significant and original ecological studies over the years have been contributed by the strong botanical element in successive teams of investigators; together with similar research by their counterparts in the realms of entomology and allied disciplines; and of course by the bird census takers, who have consistently achieved quotable results, not only for our own journals but deemed worthy of note in a variety of external publications. For the vegetation, Ella Hillman contributed between 1972 and 1979 four papers, the first of which described the changes in the distribution of trees and shrubs on the Common back to 1953, and included distribution maps for 22 of the 43 species surveyed. This was followed in 1973 and 1979 by two papers resulting from a seven-year survey of that distinctive winter-flowering plant, the butcher's broom *Ruscus aculeatus*, undertaken in conjunction with Joan Stoddart, Audrey Warren and others. More highly concentrated in the Bookham woodlands than in most others, *Ruscus* continues to baffle us in the matter of how, or indeed whether, its fruits are dispersed.

Hillman's 1975 paper on the bryophytes was the expression of a selfless determination to ensure that the collected observations of C. P. Castell, who sadly had been incapacitated by a stroke in 1967, when himself about to prepare the material for publication, should be put to good use and, together with a contribution by J. H. G. Peterken, provide an initial basis for further study. The bryophytes were featured by A. E. Le Gros and R. C. Stern in most of the Progress Reports thereafter up to 1981, detailing species new to the list, or rediscovered after an interval, or found in fresh sites. Le Gros noted that the liverwort *Lunularia cruciata* had spread in the previous 10 years about the streams and ditches after they had been cleared. He observed that the reproductive tissues or gemmae of the plant, which are sticky, could be found adhering to the shell of the small freshwater snail *Potamopyrgus jenkinsi*, which thus became the involuntary agent of their dispersal. The liverwort *Riccia fluitans*, Le Gros remarked, is undoubtedly transported, as may be duckweed, on the feet or adhering to the plumage of waterfowl; and before being reduced by the combined effects of dry summers and pond clearance could be found widely on the many waters of the Common.

A survey of 113 species of hepatics and mosses during the nine years to 1981 was embodied in the paper by R. C. Stern and O. B. J. French which appeared in *The London Naturalist* **62**. The authors, it should be noted, were not content merely to compile a list; they presented an analysis of the distribution of each species through the various divisions of the Common, together with notes on abundance or scarcity, and habitat preferences. In his last entry, in *L.N.* **67**, French proposed an investigation of the canopy-dwelling bryophytes, now brought within reach by the storm of 1987. It is much to be regretted that Oliver French did not live to realise this ambition. [However, see p. 141 of this issue. Ed.]

Forty-eight species, representing the epiphytic lichen flora on the Common between 1953 and 1956, were compared by J. R. Laundon with a mere 36 species noted between 1969 and 1973. No species was found to have increased, some which formerly were common had declined, and 25% had become extinct. Laundon, in his paper in *The London Naturalist* **52**, gave their status in the two periods, and concluded that the *Xanthorion* had disappeared from its two main habitats on the plains due to the cessation of grazing. The decline in the woodland species was likely in his view to have been due to increased sulphur dioxide air pollution, the human population in the expanding residential areas of Bookham and Fetcham having doubled between 1951 and 1973. Laundon re-examined the lichens in November 1980 (*L.N.* **60:** 65-66) and reported that there had been no significant improvement, but no decline either. He concluded that 'as lichen epiphytes are known to be accurate guides to air quality, the stable situation indicates that air pollution at the Bookham Commons remains fairly constant' – at least, up to 1980. A single example of the pollution-sensitive species *Parmelia caperata*, first noted in 1973, was still present in 1980 and had expanded from 3 cm to 5 cm in diameter.

Another difficult group for which the survey has been fortunate in receiving specialist attention is that of the Myxomycetes or Mycetozoa. In 1963 the total number of species known on the Common stood at 31, a figure which was increased to 40 by 1967. In the full list given by P. C. Holland (*L.N.* **47:** 87-88) in 1968, some were represented by single records, others by several records, two were described as frequent and there was one new record, *Physarum psittacinum*, for vice-county 17 (Surrey). Another rarity was *Stemonitis virginiensis* which, as its name implies, is known essentially from the New World. An example found in Central Wood in July 1965 proved to be only the fifth British record (Holland, *L.N.* **48:** 128). Specialist attention has been given also to the fungi, recorded not only from the woodlands but from many other habitats and on plants of various groups. Thanks to Ella Hillman and Pamela Goldsmith, species new to an already long list have been added annually since 1974. It is hoped that it will soon be possible to update the list, now in the region of 500 species, and address the problems of succession, distribution, habitat requirements and the use of fungi as a food source by the animals of the Common.

A notable botanical project underaken in recent years has been the three-year survey by Bryan Radcliffe and Ken Page (*L.N.* **60:** 68-84), begun in 1977, of 451 fully identified and located species of vascular plants. The resulting systematic list occupied eleven pages of *The London Naturalist*, but was much more than a bare list. Recording at Bookham since 1953 has been on the basis of 20 divisions of approximately equal size, lettered A–T. For all species in the list, continued presence, gains or losses were given for each of the divisions in which they occurred, and comparisons made with a similarly comprehensive survey by A. W. Jones and others in 1953 (*L.N.* **33:** 25-47). In the course of an analysis and discussion of the results, the authors concluded that although the number of species recorded in both surveys was remarkably constant, differing by less than 4%, there had yet been significant changes. For example, many species had been found in totally different divisions in the two surveys. The evidence, both visual and statistical, pointed to open-ground plants having retreated before a substantial migration in a south-westerly direction of plants from the woodlands.

The varying fortunes of a small area of formerly elm woodland, known as Station Copse, were studied between 1975 and 1983 by Joan Stoddart (*L.N.* **63:** 137-138). The Copse had previously been surveyed in 1958, but the death of the elms in 1972 and 1973, and the use of heavy machinery for their removal, introduced an unexpected complication in the comparison of the flora. The opportunity was not lost to record the regeneration of both woody and herbaceous plants. After an interval of 17 years, the suckering elms have now reached a height of 20 feet and the white-letter hairstreak – a butterfly for which the buds, seeds and leaves of the elm, usually the English elm, form the essential pabulum of its larva, and which has as a consequence sharply declined – was seen more than once in Station Copse this summer.

News of the latest plant discoveries in the study area is given regularly in the annual Progress Reports. Although the vegetation has been continuously monitored for so long, it is true that new species continue to be found, or re-found after a long interval. For example, the discovery by Olive Maunder in 1984 of the rare native grass *Bromus commutatus* reaffirmed its presence, in the same and only division, after remaining undetected for 30 years (*L.N.* **64:** 104). Bryan Radcliffe, in his article entitled 'Persistence, opportunism and translocation in plants' in the April 1990 issue of *The London Atalanta*, reminds us that a long-term survey may reveal some other somewhat surprising examples of persistence. 'At some unknown date', he wrote, 'a single plant of asparagus became established – whether deliberately planted or resulting from an adventitious seed we shall never know. It was first noticed in 1950 and is still present, so this individual is at least forty years old and possibly a great deal older.'

Ken Page has recently drawn attention to the advantage to be had, when looking for ferns, of noting their persistently green fronds showing up conspicuously against the browns of the autumn and winter vegetation. The rare, scaly male fern *Dryopteris affinis* is now represented by four plants on the Common, having first been discovered in 1979. The lady fern *Athyrium filix-femina* was known solely for many years in only one division, but now is present in five. The changing status and distribution of these and other scarce ferns is discussed by Page in *L.N.* **68:** 135.

The same author has investigated the presence of naturally occurring plant hybrids (*L.N.* **66:** 158-159). Three crosses appear to have been lost since the 1953 survey, but four have been gained to give a total of ten. One of the most conspicuous is a willow of the form *basfordiana* which has shining, bright orange twigs during winter and is to be found along Central Ditch. The anomaly of seven examples of the purging buckthorn *Rhamnus catharticus* and one of the alder buckthorn *Frangula alnus,* all growing on the moderately acid London Clay of the plains, is noted by Page (*L.N.* **65:** 181); an anomaly because the former is typically a plant of the chalk and the latter of peaty, acid soils.

The precise knowledge of the composition of the Bookham flora has recently been applied to confirm, by perhaps an unexpected route, our long-held belief that the woodlands of the Common are of ancient origin. The basis for the reasoning is a list of 99 plants which authorities agree are indicator species of ancient woodland. Radcliffe, in his contribution to the Progress Report for 1987 (*L.N.* **67:** 148-149) gives cogent reasons for accepting that the potential for such woodland as occurs at Bookham could not exceed 79. No less than 58 of these species are present and thus provide significant evidence for the antiquity of the Bookham Common woodlands.

> At this point I would like to show you a few slides: initially, to illustrate some of the matters we have discussed so far, and then some of the ponds, which we will discuss next; and, if there is time, a tiny sample of the enormous number of insects of many orders which are known to occur.

The Bookham stream, and especially the various ponds, would disappear from view if left to themselves. Certainly by last year, perhaps earlier, Kelsey's Pond for example – an isolated pond in the northern woodlands – had ceased to exist as a waterbody, and was nothing more than a dark, damp hollow beset by invasive shrubs, and deeply shaded beneath an interlacing canopy of deciduous trees. This summer, sufficient trees were removed to provide a sunlit clearing and, with the aid of a sensitively operated earth mover, the tangle of shrubs and ground cover gave place to a re-formed pond with a natural clay base graded to different depths. In the rain-starved months of this summer of 1990, when this and other ponds here and elsewhere were dry, a few infrequent showers were enough to induce a green carpet, barely an inch high, over much of the exposed clay. This proved to be *Callitriche*, the water starwort, of two species. With the onset in autumn of the long-awaited rains, this bright green carpet became immersed by the rising water, and at once took on the more recognisable character of *Callitriche* as a fully submerged aquatic. The first dips of a plankton net in early November brought out from the limpid shallows two small larvae of the *Dytiscus* beetle.

Such a pattern of decline and rebirth may be traced in the records for most of the ponds. Of three bomb-craters on the plains, only Crater Pond, near the Survey hut, has survived. Caused by a bomb in the winter of 1940-1941, its appearance in 1950 is shown in Fig. 1 of *The London Naturalist* **34.** A dense growth of willows, reedmace and other aquatic vegetation led to the need for clearance in 1962, but within 10 years Hillman (*L.N.* **52:** 74-75) reported that it could again be located only with difficulty, as a dried-up hollow in dense, developing scrub. This was cut back in 1972 and again last year (1989). Although this small pond has dried out in all but the wettest summers, it has annually been the haunt of a varied invertebrate population, and of both palmate and smooth newts; notably the 40 recorded, and returned to the water, on a day in June 1986 (Swinney, *L.N.* **66:** 160).

The only other pond now to be found on the plains is Bayfield, a small pond near the western edge of the Survey area, thought to have existed for at least a century (Le Gros, *L.N.* **52:** 75). The other seven main ponds are all in woodland. Sheepbell pond in the north-east is spring-fed and suffers less than the others in times of drought, but is shaded by tall trees from which it receives leaves in such quantity that periodical dredging and raking are essential. Such treatment in the winter of 1988-1989, for example, was followed beneath its duckweed-covered surface in June 1989 by an apparent marked increase, compared with 1985, of such invertebrates as *Gammarus, Corixa, Chironomus* and *Asellus* (Day, *L.N.* **69:** 129).

South-East Pond, hidden from the main paths by a dense secondary growth of shrubs and saplings beneath tall trees, not unexpectedly requires the periodical clearance of excessive leaf fall and the cutting back of overhanging vegetation. Following maintenance of this kind in 1963, and again in 1977, it was described by Bratton and Langlois (*L.N.* **64:** 133-136) as being one of the two best ponds on the Common in 1983. This was attributed to the plant communities being still in various stages of development, with submerged aquatics being not all-enveloping and emergent vegetation restricted to the margins. South-East Pond was one of the three ponds selected by Ruth Day for an extended study of the damselflies and dragonflies, and was described by her as being teeming with aquatic life in 1986 (*L.N.* **66:** 176).

The remaining water bodies of the Common are a chain of narrowly connected ponds, named successively Upper and Lower Eastern Ponds, then the two large ponds which have been formed in the present decade by the excavation and clearance of depressions known as Eastern and Western Hollows, and finally the Isle of Wight Pond; so termed for its proximity to the oddly named Isle of Wight, an enclosed area containing the warden's cottage and a few others, with associated gardens and paddocks, more or less in the middle of the Common. At their best, sadly not seen in this dry summer of 1990, these five ponds are collectively a notable asset, both aesthetically and for their interest as evolving ecosystems.

They have been studied and recorded in considerable detail. The present cycle of Lower Eastern Pond, for example, may be considered to have begun in July 1976, when it was partially cleared of scrub and broad margins were formed on two sides. The following spring marshy conditions developed when it was temporarily drained, and Radcliffe provided in the Progress Report for that year a notable list of flowering aquatics, including the very local *Ranunculus trichophyllus*; and was moved to comment that for variety of plant life Lower Eastern at that time was unsurpassed (*L.N.* **57:** 63). Bratton and Langlois (*loc. cit.*) confirmed in 1983 that favourable conditions still prevailed, but sounded a note of caution by remarking on the rapid spread of the *Sparganium/Typha* marsh. This continued unchecked, and in the very wet summer of 1985 a rising water level contributed to the advance. Andrew Merritt carried out between June and October 1986 a programme of invertebrate sampling, together with a series of chemical and physical tests, and concluded that Lower Eastern continued to be eutrophic with an abundance of aquatic flora (*L.N.* **66:** 157). At least until 1987, such submerged aquatics as hornwort *Ceratophyllum demersum* and Canadian pondweed *Elodea canadensis* continued in quantity, together with a surface covering of duckweed, mostly *Lemna minor*. In the summer of 1988 the water was observed by Ruth Day, in the course of her frequent visits, to have become unobscured by weed of any kind, and a number of sizeable carp could now be seen. It was not unreasonable to conclude that these had been introduced by persons with an interest in adding to the piscatorial attractions of the Common; and that the floating and submerged aquatics of Lower Eastern Pond, not to mention a proportion of the invertebrates, had helped the carp to become that much larger. The pond is now devoid of fish, every vestige of water having disappeared in this summer's long drought, and serious consideration is being given to control of the *Sparganium* and *Typha*.

It should not, of course, be thought that success and full understanding unfailingly attend our efforts. Perhaps the most tantalising enigma of all is the still unexplained failure of the biggest of the ponds, the Isle of Wight Pond, to continue its recovery after a programme of management undertaken by The National Trust in the winter of 1972-73. A full history by Beven and Radcliffe of the events up to and after that date is to be found in the Progress Report for 1977 (*L.N.* **57:** 61-62). The presence in the summers of 1973 and 1974 of an abundance of aquatics and invertebrates was at first seen as a successful outcome of the bold decision to remake the pond; but progress slowed and went into reverse, so that five years after the event we find the authors of the Report sadly concluding that, although various theories had been advanced, the true reason for the failure and continuing paucity of aquatic plants was unknown. This is equally true today.

Year by year, contributors to the Progress Reports have detected no change for the better. Ben Arthure carried out an investigation of eight invertebrate groups in April 1978, and concluded that the low diversity of species, as revealed by the Shannon Index used, but high concentration of an isolated group, the ostracods, was characteristic of polluted water, thought to be due in this instance to an excess of suspended clay particles (*L.N.* **58:** 40-41). Notwithstanding the removal of large numbers of carp, rudd, roach, perch and bream, more than 1,000 in total and mostly small, in May of that year (Beven, *L.N.* **58:** 41) conditions continued much as before. The pond is regularly fished by members of an angling club and a carp weighing 5½ lbs was caught in 1985. In 1986 the tests undertaken by Merritt, already referred to in relation to Lower Eastern Pond, included the Isle of Wight Pond, and confirmed Arthure's findings eight years previously that suspended clay particles, rather than organic matter, were responsible for continuing high levels of suspended solids. Merritt concluded that his readings of pH, hardness, conductivity and ammoniacal nitrogen concentration were all at levels conducive to plant growth (*L.N.* **66:** 158).

One of the key figures of the recent past was Armand Le Gros. A naturalist of outstanding ability, Le Gros noted the neglect of a diverse, fascinating, sometimes bizarre, often beautiful group of aquatic plants, the algae, which had not featured in the reports since 1949. 'Two algae described as epibiotic on water-fleas', wrote Le Gros, 'have been recorded in Britain in the last twenty years, one new to science. I looked for them in 1970', he continued, 'and found both on *Daphnia pulex* from Lower Eastern Pond' (*L.N.* **50:** 102). 'Epibiotic', of course, is the term given to animals or plants which derive benefit from attaching themselves, usually without much harm, to other living things. Tiny, unicellular algae may be found at Bookham attached to larger algae, such as desmids, and not only to animals the size of *Daphnia* or *Cyclops*, but even to microscopical animals, the protozoons. Le Gros continued to identify and record algae, including the branched *Cladophora* and the milfoil-like *Draparnaldia*. John Coles in 1986, and I myself in 1989 and 1990, noted that the alga *Ceratium hirundella* was present in some, but not all, of the ponds in such numbers as to turn the water green (*L.N.* **65:** 184, **69:** 122-124). Now generally accepted as an alga, *Ceratium* was formerly held in the Mastigophora, a division of the Protozoa; a classification doubtless influenced by its appearance in life – dense, armoured, free-swimming hordes in constant motion. The protozoons have not figured largely in the reports, a notable exception being the trumpet-shaped *Stentor*, first recorded for the Common by John Coles in 1984, and found several times since, including 49 on the underside of a duckweed leaf. There are also records of the Peritrichia, a protozoon group which includes such glass-like, vortex-producing, often colony-dwelling animals as *Vorticella* and *Carchesium* (Coles, *L.N.* **63:** 125; Ashby, *L.N.* **69:** 122-124).

Le Gros was the first to recognise at Bookham four of the five species of *Hydra* now allowed by recent taxonomy for British fresh waters (*L.N.* **49:** 97). J. W. Coles, J. H. Bratton and others have contributed numerous records of such worm-like groups as the turbellarians, nematodes, oligochaetes and leeches, and these are given, with their sites, in the Progress Reports in almost every year. Of nine species of nematodes collected by Coles in the Isle of Wight Pond between 1958 and 1963, and determined by him, three at the time of publication (1969) were new to Britain (*L.N.* **48:** 128-129). In October 1982, a turbellarian identified as *Dalyellia viridis* was found by Bratton to be abundant in a temporary pool on Western Plain. It is named for the bright green colour of the body, due to the presence of unicellular algae which live internally in a symbiotic relationship, partly fulfilling the nutritional and oxygen requirements of the host in return for its waste products (*L.N.* **62:** 90). 'Bookham', wrote Le Gros in 1974, 'appears to be the last recorded station in the home counties for the medicinal leech (*Hirudo medicinalis*). Considered at the beginning of the present century to be extinct in Britain, it has since been found to survive in a number of small pockets, mainly in the west'. Le Gros quotes confirmed Bookham records for 1938 and 1947 (*L.N.* **53:** 74). Two further records, for 1955 and 1961, are given by E. W. Groves, who provides a valuable commentary on the biology of this by now little-known species (*L.N.* **54:** 45-46). The source of vertebrate blood since the disappearance of farm animals from the Common may of necessity have been amphibians, waterfowl or even fish, but the presence of roe-deer since 1968 may now be another source. Certainly, I have seen roe-deer at evening visit Upper Eastern Pond to drink.

The Rotifera are taxonomically close to the worms, but only the bdelloid or creeping species have any slight similarity of appearance. Others are free-swimming and still others are sedentary. Their transparent bodies reveal a complex internal structure and organisation, notwithstanding that some are smaller than some protistans. The first list, consisting of sixteen species, together with the water-bodies in which they were found in 1982, was given by C. G. Hussey (*L.N.* **62:** 90). Coles and others have published a number of additions, including the sessile genera *Stephanoceros*, *Floscularia* and *Collotheca* (*L.N.* **67:** 151, **68:** 136, **69:** 125).

It is usually impossible to test for the presence of rotifers without the fine-meshed net taking up quantities of the small freshwater crustaceans. These comprise the bean-like ostracods, the cladocerans or water-fleas, such copepods as the various species of *Cyclops*, the amphipods or freshwater shrimps, and the isopod, *Asellus*. Additions to the original list given by Castell (*L.N.* **37:** 57-58) appear almost annually in the Progress Reports. A valuable checklist of the Cladocera up to 1974, with dates and sites given, was compiled by John Hearn (*L.N.* 39-45). The well-known water-fleas *Daphnia pulex* and *D. longispina* both occur at Bookham, and produce a variation consisting of a row of minute hooklets on the dorsal margin of the headshield. Such variants are quaintly known as the 'Minnehaha' forms of these two species, and both are recorded from the ponds at Bookham. The Minnehaha form of *Daphnia pulex* appears to be the rarer, and at the time of Hearn's checklist in 1974 the record from Lower Eastern Pond in 1971 was only the second for Britain. Coles records that a crayfish *Astacus pallipes,* three inches long, was found dead in Bookham Stream in May 1988 (*L.N.* **68:** 136).

In his stimulating paper entitled 'Ecological aims and methods for zoologists', which appeared in *The London Naturalist* for 1948, O. W. Richards remarked that 'the process of listing, in the case of insects, is even more difficult than is commonly supposed'. Undeterred, our entomologists have, since the earliest days of the Survey, compiled and up-dated lists for most of the main orders of insects, and have lost no opportunity to look at the wider ecological implications. The dragonflies, for example, were first listed, and discussed in relation to habitats and frequency, by L. G. Payne in 1945 (*L.N.* **24:** 23-31), and further Bookham records were given by Longfield four years later (*L.N.* **28:** 80-98). In 1982 and 1983 a new survey of the Odonata was conducted by Bratton and Langlois (*L.N.* **63:** 133-136), enabling comparisons of the status and distribution of 15 species to be made with Payne's survey some 39 years before. Bookham is one of the known sites for the handsome, but locally distributed, ruddy darter *Sympetrum sanguineum,* a dragonfly which breeds but sparsely in Surrey and has a preference for ponds with undisturbed, muddy margins and lush emergent vegetation. Not infrequently seen, but not yet confirmed as a breeding species at Bookham, this is a species which clearly indicates the need for a sensitive approach to pond maintenance and control. Of all the ponds on the Common, only the remote and secluded Sheepbell Pond is now attractive to the large red damselfly *Pyrrhosoma nymphula.* Widespread in Britain, but declining in the London Area (Brooks, *L.N.* **68:** 112), this species will derive some advantage, it is hoped, from the recent cutting-back of overhanging trees, affording more light to the marginal vegetation (Swinney, *L.N.* **68:** 134).

A long-term population study of the damselflies was begun by Ruth Day in July 1985 and the findings over five summers have been published. In the course of daily visits at critical times of each year, males of *Coenagrion puella*, *Lestes sponsa, Ischnura elegans* and *Enallagma cyathigerum* were captured, marked with felt-tipped pens of various colours, and released unharmed. A computer programme was written and, by incorporating also the data obtained by recapturing marked individuals, population estimates were derived. This was clearly an entirely new departure for the fieldwork at Bookham, and the results and conclusions following 42 days in the field are very clearly set out and discussed in successive issues of *The London Naturalist,* starting with No. 66. This ambitious programme, all the more noteworthy for being carried through without assistance, was supplemented by netting for the aquatic stages, an aspect of dragonfly study on the Common not previously investigated. The outcome of it all has been a new understanding of the size and variations of the populations and the factors involved. The meticulously presented results make fascinating reading.

It is impossible to trace through the records for the more obscure orders of insects without recognising the value of the contributions made by Armand Le Gros. Eight species of the Psocoptera or bark-lice in 1968 (*L.N.* **49:** 98), additions in 1972 to the survey of the Hemiptera-Heteroptera conducted by Leston (*L.N.* **31:** 49-62, **52:** 77), and the re-finding in 1972 of the scorpion fly *Panorpa germanica (L.N.* **52:** 77), last recorded in 1904, are tributes to his perception and skill in the field. Until recently the list of the Neuroptera or lacewings stood at 13 species, determined by Le Gros in 1952-1953 (*L.N.* **46:** 111), but there is now a notable addition: an adult of *Drepanepteryx phalaenoides,* a very scarce species hardly known in the south of England, was beaten by Dr Ian Menzies from holly in Hill House Wood in March 1989 (*L.N.* **69:** 126).

By bringing together the observations of A. M. Emmet, W. H. Spreadbury, A. S. Wheeler and others, to which he added his own, Le Gros drew up in 1976

FIG. 4. Collecting leaf-hoppers, larvae and other insects from trees and bushes by using a beating-tray.

a first working-list of the Microlepidoptera – the leaf-miners, the case-dwellers and other small, even minute, moths – recorded on the Common, together with such notes as were available on their distribution and food plants (*L.N.* **56:** 77-81). This list totalled 91 species of 14 families and was supplemented in 1985 by 18 new species located by Colin Plant (*L.N.* **65:** 185-186). Students of the micromoths will perhaps recognise *Diurnea fagella* from W. H. Spreadbury's account, quoted in the list, of finding 'the caterpillar with the Charlie Chaplin feet all too frequently when beating sallows'.

A list of the butterflies and larger moths was assembled in 1955 by A. S. Wheeler (*L.N.* **34:** 28-36). The results of further sampling by G. A. Collins and others were summarised by Beven in 1988 (*L.N.* **67:** 151-153), advancing the total of macromoths to 318, being 60% of all species known in the London Area. Although Bookham is, as we have seen, an area of predominantly deciduous woodland, such pine feeders as the bordered white *Bupalus piniaria* and the barred red *Hylaea fasciaria,* and even the pine hawk-moth *Hyloicus pinastri* figure in the list. The oak feeders include the coveted merveille-du-jour *Dichonia aprilina* and the oak beauty *Biston strataria,* both extremely handsome when seen at close range, but next to impossible to detect, by reason of their remarkable crypsis, when at rest on tree bark.

Most of the butterfly species discussed by Colin Plant for the London Area in his recent book on the subject (Plant 1987) are to be seen or have been seen at Bookham. A modern review of the butterflies of the Common by Alan Wheeler provides an assessment of the status and frequency of 40 species (*L.N.* **68:** 143-146), for comparison with his list published 34 years previously. As elsewhere, the history is all too often one of decline. But at least one species, the holly blue *Celastrina argiolus* may be increasing and others, such as the gatekeeper *Pyronia tithonus,* the ringlet *Aphantopus hyperantus,* the purple hairstreak *Quercusia quercus* and the orange tip *Anthocharis cardamines* remain plentiful. In a lecture given before the Society in May 1984, Mr Paul Sokoloff advanced the view that it is not necessarily essential for a species to maintain a large numerical presence to ensure its survival; and that it might continue at a low density during lean years, from which it could build up its numbers when conditions became more favourable. This principle may be operating at Bookham now in relation to the white-letter hairstreak *Strymonidia w-album*. Formerly well represented, its absence following the loss of the elms in 1972 and 1973 has already been mentioned. From then until its reappearance in 1989 (Swinney, *L.N.* **69:** 126) and 1990, Wheeler's record of one in 1976 is the only evidence of perhaps its continued presence.

A lover of sunlit clearings in the woods, the white admiral *Lodoga camilla* continues to reward the observant on fine days in July and August. Its dependence on the wild honeysuckle *Lonicera periclymenum* is recognised, and this plant is left whenever possible in the course of woodland maintenance. Ian Swinney, in his maintenance report for 1989 (*L.N.* **69:** 119-120) describes the planting of goat willow *Salix caprea* at woodland edges to provide additional food-plants for the purple emperor *Apatura iris*. This is the butterfly which those attending the annual butterfly walk, arranged by The National Trust and led by K. J. Willmott, hope most to see. If the weather is kind they are very likely to succeed, for this fine species is well established on the Common and has been the subject of a detailed life-history study (Willmott 1987). The first marbled white *Melanargia galathea* recorded for the Common was seen by D. A. Boyd in 1985, and another was discovered by Ian Menzies in 1989; both on grassy areas of Bayfield Plain.

In furtherance of the general aim to take account of all natural groups in the study area, successive investigators have worked at various times on most of the insect orders. Leonard Parmenter, together with Montague Niblett, listed more than 1,200 species of two-winged flies from the Common and the resulting index of the Bookham Diptera – exceeding that for any other comparable area of the country – has been deposited with the Natural History Museum in South Kensington, together with supporting field notes. A fly of the family Pipunculidae, then new to science and found by Parmenter on Bookham Common in 1960, has been named after him: *Chalarus parmenteri* Coe (Beven, *L.N.* **49:** 93). Parmenter's first monumental paper on the Diptera of the Common appeared in 1950, and the systematic list included much supplementary information on habits, distribution throughout the study area and times of appearance. Additional lists separated the populations into those which visited fungi, carrion and flowers, further divided into individual lists for flowers of different colours; 65 flowers in all (*L.N.* **29:** 98-133). A second paper was published nine years later; besides adding substantially to the list, it discussed bird predation of the Diptera, with many observations of the flies taken by birds identified to family (*L.N.* **39:** 66-76).

This brief digression into events preceding 1968, the intended start date of this present review, is salutary in that it must be admitted that the momentum of this able programme of research into the enormous order of flies has not been maintained. The opportunity surely exists for dipterists to come forward and build on the groundwork already done so conspicuously well. Additions to Parmenter's lists were published by Le Gros in 1972 and 1974 (*L.N.* **51:** 41, **53:** 75); and 18 species of hoverflies new to the list, collected by G. A. Collins, were given by Beven in the Progress Report for 1987 (*L.N.* **67:** 153).

Stimulated by Parmenter's close observations of which species visited which flowers, A. E. Le Gros identified to species level numerous insects of five orders seen visiting flowers of the bindweed *Calystegia sepium*. Comparing the results at Bookham with similar observations elsewhere, he concluded that *Calystegia*'s most regular visitors, all of which worked their way down into the heart of the flowers, were a limited number of named species of social bees, hoverflies and a small, day-flying moth *Simaethis fabriciana*. Le Gros then went on to investigate the insect visitors to the corn sowthistle *Sonchus arvensis* and the results were compared (*L.N.* **49:** 100-101).

Not all plant galls are caused by insects, but certainly there are a great many galls for which tiny midges and wasps are responsible. Their study is complicated by some galls being tenanted a second time, a gall inhabitant not necessarily being the gall maker. In 1969 Le Gros examined over 2,000 oak galls from Bookham and Chislehurst, and compared them in his paper 'Gall midges of the pedunculate oak' (*L.N.* **51:** 63-67). This included a useful set of references, notably to Niblett's work 15 years before on the gall midges found to be affecting a wide range of trees and herbaceous plants at Bookham. A further gall-making agent is the gall-wasp, and galls caused by 40 species of gall-wasps at Bookham were included by Niblett in his wider study of the gall-wasps of the London Area, which appeared in 1958 (*L.N.* **37:** 126-135); to which Le Gros in 1972 restored some Bookham records of intruder species which feed, often to the disadvantage of the rightful tenant, on the gall tissue (*L.N.* **50:** 104).

Yet further gall causers are a host of tiny arachnids, the gall-mites, which are so many and varied that Le Gros, in his 1972 paper on 27 species described for Bookham, was moved to remark: 'it would seem that every common plant has its own particular gall mite' (*L.N.* **51:** 68-76). The value of galls as a food source for birds was investigated by Beven and others in 1966 and further in 1968. In the note for the latter year, it was recorded that 58% of 239 galls checked had been opened by birds and the larvae extracted (*L.N.* **48:** 134). By contrast, the failure of the acorn crop in 1980, as recorded by Radcliffe (*L.N.* **60:** 64-65), posed a threat to animals for which acorns are an important item of their winter diet. The appearance on the Common of the destructive knopper gall *Andricus quercuscalicis* in 1977 continues to result intermittently in a significant loss of developed acorns. As Hillman observed in her report and careful investigation of the subject in 1987, it is unlikely that the gall threatens the regeneration of the oakwoods, but it is not known how its interference with the food supply of small animals may affect their populations (*L.N.* **65:** 182).

On 12 May 1974 Le Gros found two cocoons of a spider-hunting wasp in a moss-packed cell in the stem of an umbellifer on Central Plain. From these there emerged in the first week of June not the wasps but two males and 33 females of a chalcid parasite. Specialist determination by Dr R. Askew revealed that as *Eupteromalus pompilicola* Graham they constituted the first definite English record of the species. The males hiterto had been unknown (*L.N.* **54:** 47). The versatility of this perceptive observer has already in this review been demonstrated many times, and to Le Gros we are indebted for the only investigation of the ants of the Common. Eleven species are detailed in a report which records also the presence of three commensals – a spider, a fly and a millipede – in the workings of the uncommon tree-dwelling ant *Lasius brunneus* (*L.N.* **48:** 131). P. W. E. Currie in 1969 and 1970 contributed our only other statements on the Hymenoptera of the Common. The first of these was a paper on a somewhat primitive group, the sawflies; of which about a third of the 500 species in Britain are recorded for Bookham. Unlike so many others of this mainly carnivorous order, the larvae of sawflies are plant feeders, often resembling the larvae of butterflies and moths and occurring openly on vegetation; but some are leaf rollers, leaf miners or gall dwellers. Currie's fine paper offers biological data of much value and is the outcome of a ten-year study (*L.N.* **48:** 142-149). Forty-one species of mostly solitary wasps – known collectively as digger or mason wasps, which make earth burrows or divided chambers which they may stock with food for their larvae as diverse as shield-bugs, aphids or spiders – were listed by Currie in 1970; together with two records of the hornet *Vespa crabro*. As with the sawflies, biological notes were included (*L.N.* **49:** 99-100).

One of the best-documented orders of insects on Bookham Common continues to be the Coleoptera. References to the pioneering work of Castell, Coulson, Easton and Payne in the first 25 years of the Survey are given in the bibliography which accompanied Beven's 1967 review (*L.N.* **47:** 95-102). The Progress Report for 1967 (*L.N.* **47:** 89) noted the discovery by Dr A. M. Easton of two carrion beetles of the genus *Acrotrichis*, and by J. L. Henderson of seven examples of the beetle *Chaetocnema aerosa*, all three species being new to Britain. The checklists of species by F. J. Coulson and L. G. Payne were supplemented by 19 species recorded by Derrick Hall in 1967 (*loc. cit.*), whose two further valuable contributions to the Coleoptera were a paper in 1977 on the Hydradephaga, of which 30% of the British species have been found on the Common (*L.N.* **56:** 75-76); and a paper in 1979 which presented further information on twelve families (*L.N.* **58:** 56-58). That beetles, and Diptera, may be used to assist forensic examinations is becoming more widely known; a less frequent application of the coleopterist's skill is surely the identification of a former occupant of a tree hole by noting the beetles found within. Richard Jones (*L.N.* **57:** 64) investigated a hollow limb of an oak and checked the beetles in the wood dust. Five of the species were known frequenters of birds' nests and one of them, to quote Jones' note, was apparently specific to the nests of owls. The death of the elms, already mentioned in connection with their dependent butterfly, was expertly discussed by Jones in 1979 (*L.N.* **59:** 62-63) in terms of the beetle fauna before and following the event. A valuable list of beetles, of 10 families, new to the Common has recently been contributed by Dr Ian Menzies (*L.N.* **69:** 126-127). This includes two *Red Data Book* species in the Buprestidae, one each in the Mordellidae and Chrysomelidae and, recorded jointly with Professor John Owen, *Platypus cylindricus* in the Platypodidae. A feature of nearly all the species lists throughout the history of the Survey has been the inclusion wherever possible of data of a biological and ecological nature; Dr Menzies' list of new beetles is, of course, similarly endowed.

Two females of the beautiful and rare orb-web spider *Araneus alsine* were found at Bookham in September 1951 by D. Macer-Wright, the determination being confirmed by Douglas Clark. These considerably pre-dated others found at Box Hill and elsewhere in 1968 and thought to be the first for Surrey. A voucher specimen from Bookham is lodged at the Natural History Museum in South Kensington (Le Gros 1973; *L.N.* **52:** 76). A revision of the Arachnida undertaken by Le Gros in 1972 brought the recorded total of spiders to 201 (*L.N.* **51:** 68-76). In assembling the list from his own observations and the findings of several independent contributors over a period of years, Le Gros thought it unwise in this instance to relate the records to specific habitats or areas. Valuable biological information was contained in Le Gros' accounts of his observations on eulophid chalcids and ichneumons, including their relations with each other and with their spider victims (*L.N.* **50:** 105, **52:** 77). A web-spinning spider new to the Common, *Tetragnatha striata*, was found by Eric Groves in July 1981. The site, not entirely typical for this species, was a clump of the soft rush *Juncus effusus* growing, not at the water's edge, but on a moist, clay soil 400 metres from the nearest pond (*L.N.* **63:** 126).

In concluding this part of the review, dealing with the invertebrates, I am conscious that there are a few omissions. The Survey has been fortunate in attracting over the years so many experts in so many groups, but inevitably some groups will have suffered by not having a specialist living within reachable distance. The wingless legions of the Thysanura, Diplura, Protura and Collembola, for example, await their devotees. Armand Le Gros provided our only note on the Collembola, describing how the *Podura* were so abundant that their shed exuviae formed a white scum approximately a square metre in extent on the surface of the water; and remarking that on a day in February, when the ponds were frozen, *Podura* and *Isotomurus* could be found in numbers on the ice (*L.N.* **50:** 103).

The regular presence of palmate *Triturus helveticus* and smooth newts *T. vulgaris* has already been mentioned when dealing with the ponds. Some of the flooded gun-pits formerly on Eastern Plain were regular haunts of these and of crested newts *T. cristatus*. David Stiles, in his note in 1977 (*L.N.* **57:** 64-65), commented on the continued occupation by newts of certain pits, and the continued rejection by them of others, as similarly reported 27 years earlier by A. L. Panchen. Stiles further noted that the young of the crested newt, which are not ready to leave the water until late August, are at greater risk from the seasonal drying out of such pits and small ponds than are the young of smooth newts, which become terrestrial in June. Crested newts have been found intermittently in the ponds, the most recent being in 1987. A summary of the known hibernation sites of newts and other amphibians was given by Beven in 1982 (*L.N.* **62:** 93), including a note of a sleepy crested newt in a slight depression in the ground under pieces of wood, and hibernating smooth newts found in mud, even in a disused nest of the yellow meadow ant *Lasius flavus*.

The early breeding of toads *Bufo bufo* at Bookham was discussed by Beven in 1982 (*L.N.* **62:** 92). Casualties left by a fire on Eastern Plain in March 1984 included 37 toads, but in the following month toads were very numerous at dusk about the banks of Isle of Wight Pond (*L.N.* **64:** 107). Shortly before midnight on 25 March 1987, Ian Swinney counted 72 toads on Common Road on their way to the ponds (*L.N.* **65:** 186). Frogs *Rana temporaria* are well represented and breed regularly. The first direct evidence of hibernation was given by Beven in 1983, including 15 frogs found in 30 cm of water in January (*L.N.* **63:** 127).

Frog bones have been found in the pellets of tawny owls *Strix aluco* at Bookham (Beven, *L.N.* **62:** 93), and frogs are preyed upon also by grass snakes *Natrix natrix*, 54 dated records of which were summarised by Beven in 1968. In an analysis of habitats it was found that although most were noted in grassland and wet habitats, 23 records were from dense oakwood, where the prey is presumably young birds and small mammals (*L.N.* **47:** 91). When the records were updated by Beven in the 1986 Progress Report, 50 sightings were in ponds and nearby wet herbage, 39 in grassland scrub and 36 in dense woodland (*L.N.* **66:** 160). Adders *Vipera beris* are much less frequent, with a mere five records in more than 40 years (*L.N.* **61:** 97). Beven summarised the known status of the slow-worm *Anguis fragilis* and the viviparous lizard *Lacerta vivipara* in 1981, both of which maintain small populations in the more open parts of the Common (*L.N.* **61:** 96-97).

The main thrust of the ornithological effort at Bookham has been, as is widely known, the regular breeding season census of the birds of the woodland, scrub and grassland. The 1968 bibliography, to which I have previously referred, lists eight papers by four authors who, between 1950 and 1964, analysed and compared the bird populations, together with their varied feeding requirements, in the different habitats (*L.N.* **47:** 99-102).

P. W. E. Currie initiated the survey of the birds of the plains with his paper in 1950 (*L.N.* **29:** 91-97). This was followed by two papers resulting from long-term studies by W. D. Melluish. The first, in 1960, was based on the census results of six winters and seven summers following the cessation of grazing by domestic animals, and led to some important conclusions as to the effects (*L.N.* **39:** 89-98). The second, in 1969, presented the results of a further five years in the field, and sought to relate observed variations in the bird populations to changes which had now been imposed in the course of management (*L.N.* **48:** 135-142). The plains are a less stable habitat than the woodlands and the annual spring census of the number of territories of singing males in scrub and grassland continued to record the changes. Beven and Melluish conducted this census on 39 hectares of the plains every year from 1968 to 1979. From 1980 to 1985 it was continued by Wilfrid Melluish and Doug and Penny Boyd, thus providing continuous comparable data for Western, Isle of Wight and Bayfield Plains for an unbroken further period of 18 years. The detailed results year by year for 11 key species are in the Progress Reports and are the continuation of a history which began in 1948.

On the Common there are some 112 hectares (280 acres) of closed forest, typical mature oak woodland on clay. In the shade of the tall and interlacing trees there is an undergrowth of bramble and a variety of shrubs and smaller trees, often forming dense thickets. The 16 hectares (40 acres) of the sample area, known as Eastern Wood, are effectively interior woodland, with minimum edge effect. In 1976 Beven undertook the very considerable task of re-working and re-stating the census results from Eastern Wood over 27 years, further assessing the changes which had taken place; but also underlining the stability which could be demonstrated in some of the 44 species surveyed and for which territories had been identified (*L.N.* **55:** 23-42). When Volume 5 of *The Birds of the Western Palearctic* – the first of the series to deal with the passerines — appeared it was a matter for satisfaction to note that Beven's 27-year Bookham review, together with three of the earlier papers, had been extracted and included in the quoted references (Oxford University Press 1988).

Papers on the bird surveys of the woodlands and plains had reached a wider readership by appearing in four external publications between 1963 and 1971, and between 1955 and 1985 three authors of books and five authors of papers in publications other than our own had drawn on the ornithological research at Bookham. The results of the annual breeding season census of the woodland birds up to 1975 had been included in the 27-year review. Beven continued with a full-scale census of Eastern Wood in 1976 and annually to 1979. A census in 1980 was not possible, but censusing was resumed by A. Merritt in 1981 and thereafter by him, L. Manns and R. H. Kettle in almost every year since, including the present year, 1990. This continuous history of the numbers and species of birds in a defined area, conducted annually with scarcely a break since 1946 (*L.N.* **30:** 57-72) has resulted in a store of accurately presented biological data without equal.

There is also a great deal of information of a more generalised nature concerning other areas of the Common and all the other bird species recorded. So much has accumulated in the printed pages that, were it not for the historical summaries published in recent years, tracing the history of any given species would be tedious. Helpful and informative summaries of selected species or groups of species were started by Beven with a review of the marsh and willow tits in 1973 (*L.N.* **52:** 79-80), of blackcap and garden warbler in 1974 (*L.N.* **53:** 76-77), and four species of doves and pigeons in 1979 (*L.N.* **58:** 42-43).

From 1982 onwards these reviews have covered successively all the essential species of the Common, appearing annually in the Progress Reports and providing profiles of each from the census results and the bird records of many contributors. Collectively, they are an expression of species schedules maintained over a long period, of crosses and territories marked on hundreds of field base-maps, of patience, of discipline, of keen observation, of countless hours in the field. Individually, each is an ecological statement, analytical, factual, striving to relate cause to effect and, wherever possible, assessing the Bookham experience against the wider scene.

I need add only a brief history of the heron, a recent colonist of the woodlands. In May 1986 a pair built a nest 15 feet up in a willow near Upper Eastern Pond but deserted, it is thought, as a result of persecution by crows. In March of the following year nestbuilding, again by only one pair, was observed but this nest also came to nothing. In 1988 Andrew Merritt reported the first successful breeding in Eastern Wood, with one or two young being seen in the nest. In 1989 one nest in Eastern Wood produced one young and of eight other nests in adjoining dense woodland two, possibly three, were occupied (*L.N.* **69:** 130).

Long-eared owls have been noted on the Common in 1944, 1979 and 1985. From mid-January to 21 April 1979 a party of up to six roosted near the Hundred Pound Bridge in thickets of blackthorn and hawthorn. From an analysis of the pellets, it was seen that the diet consisted mainly of small mammals and a lesser proportion of birds. Among the mammal remains were those of a long-eared bat *Plecotus auritus* (Beven, *L.N.* **59:** 64-65, **65:** 190). Not only was this the first evidence of the long-eared bat on the Common, it was indeed only the second bat of any species to have been positively identified. Bats are, of course, seen on summer evenings and in mild autumns even into November, but putting a name to them is another matter. The first certain bat record, that of a whiskered bat *Myotis mystacinus* was also from its bones, recovered from a tawny owl's pellet in April 1953 (Beven, *L.N.* **34:** 15); the third was another long-eared bat, found dead in Stent's Wood in May 1984 (*L.N.* **64:** 112).

Not all predators are so much bigger than their prey. Nigel Davies, formerly the Warden, once described how a charcoal-coloured weasel *Mustela nivalis* was seen to approach a rabbit which, after screaming in the undergrowth, staggered in circles until, obviously confused, it fell into a pond where it swam around until it drowned. All this time the weasel remained quite still in the undergrowth. When examined, the rabbit bore no sign of injury (*L.N.* **56:** 74). A stoat *Mustela erminea* has been seen carrying a wood-mouse *Apodemus sylvaticus*, and the shrill screams of rabbits have drawn the attention of observers to the presence of other stoats, once three together. Weasels have been more frequently under notice, including one in a tree eight feet above the ground (*L.N.* **65:** 192). Foxes are resident and will take the cottagers' poultry if they have the chance. Badgers have occupied a sett in the northern part of the Common a number of times in the last decade and cubs were seen in 1988 (*L.N.* **68:** 140).

The 1968 bibliography (*L.N.* **47:** 99-102) includes references to small-mammal trapping programmes on the Common between 1956 and 1967. No similar programmes have been instituted since, but intending trappers may be glad to be reminded that a useful key by Professor J. L. Harrison to the identification of small mammals in the hand appears in *L.N.* **35:** 12-20. Historical summaries were given by Beven for the water-vole in 1984 (*L.N.* **63:** 131), the harvest-mouse in 1989 (*L.N.* **68:** 140) and the dormouse in 1990 (*L.N.* **69:** 140-141). The harvest-mouse had become almost extinct in the London Area, and its reappearance at Bookham in 1955 and subsequently is thought to be not unconnected with an increase in the length of ungrazed grasses (W. G. Teagle, *L.N.* **43:** 136-149).

Those – and there are many – who enjoy the contest between man and squirrel at the garden bird-table may be reluctant to accept that every countryman's hand is against this engaging pirate. In the Progress Reports year by year we read that many have paid the price of their destructive ways: 136 in 1978, 155 in 1980, 80 in 1989. Wasteful plundering of the male sallow catkins, leaving a yellow carpet uneaten on the ground, an ability to find the gall-wasp larva within its cherry gall, the killing of trees by bark stripping, a taste for a variety of fungi; all these and other feeding habits are described by Beven in his note in *L.N.* **69:** 136-137. By contrast, the hedgehog is less frequently encountered, but there is a record of one devouring, of all unlikely prey, a toad (*L.N.* **64:** 112). A summary of all the records is in *L.N.* **67:** 156.

The importance of rabbits *Oryctolagus cuniculus* in the ecology of the Common has from the outset been recognised. Their ability to build up their numbers after each myxomatosis outbreak is now well known. After its initial devastating effect in 1954, the disease struck again in 1966, 1969, 1974, 1976 and in other years since. Gassing, ferreting and shooting as measures of control have produced, sometimes within a year of a serious outbreak, large numbers of rabbits which on examination appreared to be healthy. Michael Towns conducted a survey of the rabbits on Bookham Common over a two-year period, 1969-70 (*L.N.* **51:** 55-62). He found that 37 out of 43 burrows occupied in

December 1970 were sited at the edges of woodland or areas of scrub, with ready access either to the grasses of the plains or to pastures of the surrounding farms. Towns commented that the open spaces remaining on a scrub-invaded area of Western Plain were heavily rabbit grazed and maintained as open spaces solely by the activities of the rabbits from a nearby warren. Other warrens were discussed and the rabbit population shown to be unevenly distributed.

A second survey, this time by Oliver French, was undertaken in 1977 (*L.N.* **59:** 66-72). Adverse factors notwithstanding, there were more rabbits and more burrows than in 1970. Their communities had shifted to the more open parts of the northern woodlands on well-drained soils, and away from the southern and western plains. This was thought to be due to a dislike of the purple moor-grass *Molina caerulea* and bracken *Pteridium aquilinum*, then becoming dominant on the plains. The paper includes separate lists of plant species eaten and avoided by rabbits. Hairiness, spininess, toxicity and strong flavour were advanced as reasons for the evident dislike (Radcliffe in French *loc. cit.*).

Alan Wheeler, in his recent assessment of the butterflies (*L.N.* **68:** 144) noted that the decline of the pearl-bordered fritillary *Boloria euphrosyne* during the 1950s and 1960s coincided with an observed decline of the violets *Viola canina* which are the food of the larvae. This was the period of the rabbit's almost total absence following the critical events of 1954, and the release of grazing pressure, so far from benefitting the violets was, in his view, more likely to have seen them shaded out.

Not many visitors to the Common chance upon a hare, but the brown hare *Lepus europaeus* maintains a small population in oakwood and elsewhere (Beven, *L.N.* **66:** 165-166). Within a decade of its first arrival on the Common in 1968, the roe-deer *Capreolus capreolus* had become well established, and so continues. Juveniles are seen not infrequently, and both adults and kids have been attacked and killed by dogs. Improved access, resulting from The National Trust's wholly commendable commitment to the interests of the wider public, has had the unfortunate effect of increasing the number of dogs allowed by their owners to roam free. Such ground-nesting birds as the tree pipit, should it gladden us by returning, are faced with this mounting hazard.

To mark the Society's contribution to European Conservation Year in 1970 the Survey Team set up a Nature Trail on Bookham Common. It was held over two days and 14 L.N.H.S. members and friends manned the Trail and the Survey hut. A tent was pitched at the starting point to serve as an information centre and sell a printed guide. The trail sampled all the main habitats and at six staging points plants in the surrounding area were keyed to the printed guide, which included notes on the ecology and other information. The Survey hut was open and exhibited wall displays of enquiries currently in progress, and had on show specimens of grasses and other plants, pond life, casts of animal tracks, pellet analysis and much else. Local authorities, the press and the police were informed in advance, signposts were erected on the approach roads and such was the enthusiasm that some visitors returned on the second day. In total, close on 1,000 people attended (*L.N.* **50:** 98-100).

No public relations exercise approaching that has been attempted since, but the facilities of the hut and the experience of team members have been enjoyed by a number of organisations which have held field meetings at the site and have been welcome guests. These have included the Linnean Society, the British Mycological Society, the Epsom and Ewell Branch of The National Trust, the Weybridge Natural History Society, the Leatherhead Natural History Society and – several times, I am pleased to report, including this year – both the British Entomological and Natural History Society and the Quekett Microscopical Club.

I recall that it was once said of a noted politician that he was not the man to use one word when three would do. My task this evening has been to make one word do the work of three, or 30, or 3,000 in attempting to present to you the essence of a collective endeavour which has enriched the field experience of so many. Although my review has of necessity been in the most general terms, I think we have seen that the Survey continues to justify its existence, that it has produced some notable results, and that the potential for further development conforms to no other limitations than those imposed by the availability of enthusiastic and resourceful researchers in the field.

If you should have it in mind to consider in greater detail those aspects in which you yourself are particularly interested – perhaps the vegetation, or the effects of management, or the invertebrates, or the bird population studies, or the mammals, and especially the inter-relationships of animals and plants with each other and with their environment – the information is all there in the pages of our journal and awaits your eager and critical eye.

Whether you already have a developed skill, or whether your field experience is at an earlier stage, I hope very much that you will be encouraged by your reading to take some part yourself in Britain's longest-running ecological survey.

The essential qualifications are not too difficult to acquire; and if you have them I have absolutely no doubt that you would soon feel at home at Bookham. What, you may very reasonably ask, are these qualifications? They are just two: an enquiring mind and the ability to observe. And there are two vital items of equipment which you must have: a notebook and pencil, always at the ready.

Scientific names of birds mentioned in the text:

Grey Heron	*Ardea cinerea*
Tawny owl	*Strix aluco*
Long-eared owl	*Asio otus*
Tree pipit	*Anthus trivialis*
Garden warbler	*Sylvia borin*
Blackcap	*Sylvia atricapilla*
Marsh tit	*Parus palustris*
Willow tit	*Parus montanus*

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Book Review

Poplars of the British Isles. By Theresa Brendell. Shire Publications, Princes Risborough. 1990. 24 pp. £1.95. ISBN 0 7478 0093 6.

A year ago, when reviewing *Umbellifers of the British Isles,* No. 49 in the Shire Natural History series, I commented on the unsuitably large size of the group of plants covered in the small format, and the inappropriateness of its photographs. Here now is No. 58. Exactly what was wanted, a small group of plants covered in excellent detail, with line drawings or colour photographs wherever appropriate. This and the same author's earlier *Willows of the British Isles* (No. 8 in the series) together nicely complement the B.S.B.I. handbook on willows and poplars published in 1984.

RODNEY BURTON

The Geological Age of Insects†

By E. A. JARZEMBOWSKI*

Summary

The occurrence and antiquity of major British insect groups are summarised with particular reference to the London Area. A new insectiferous deposit, the Barn Elms Peat Bed (Quaternary) is described briefly from the River Thames foreshore. This horizon could be the source of the Barn Elms classical cup, a controversial archaeological find.

Fossil Insects

Some 75 percent of the one million or so described species of animals belong to the class Insecta, of which about 2.5 percent are fossil. Yet the latter show that winged insects (Pterygota – the most diverse subclass) date from the Namurian stage of the latest Lower Carboniferous (*c*.325 million years Before Present: Harland *et al.* 1990) and that the Apterygota (primitively wingless insects) are earlier still (Lower Devonian: Pragian; *c*.393 m.y. B.P.).

Records of the oldest insects are controversial. Crowson (1985) doubted the Devonian age of the earliest known insect and hexapod, *Rhyniella praecursor* Hirst and Maulik, 1926, a collembolan from the Lower Devonian (Pragian) of Scotland (Figure 1). Jeram *et al.* (1990) have doubted the antiquity of *Gaspea palaeoentognathae* Labandeira, Beall and Hueber, 1988 (*nomen nudum*), the earliest thysanuran (archaeognathan) and ectognath apterygote (*Rhyniella* is an entognath apterygote). However, the early Devonian age of *R. praecursor* has been supported by Kuehne and Schlueter (1985), Greenslade and Whalley (1986), Greenslade (1988) and accepted by Jeram *et al.* (1990).

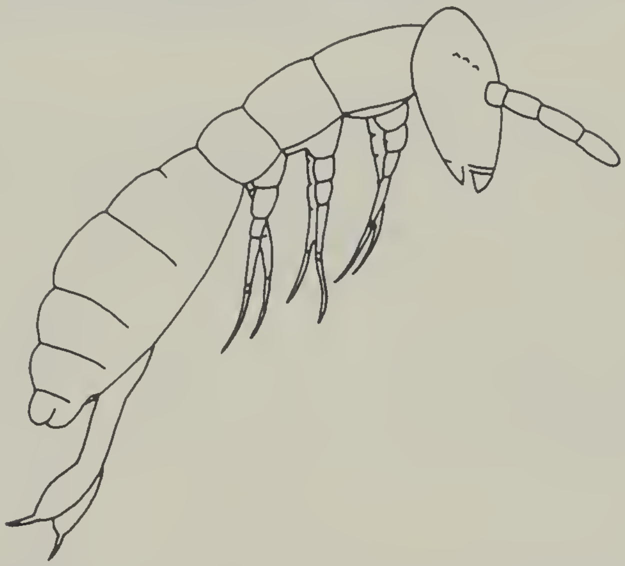

FIG. 1. The earliest insect, *Rhyniella praecursor,* reconstructed leaping, original drawing. Actual length 1.5mm, Lower Devonian, U.K. (Collembola: Isotomidae).

Because insects are readily dispersed, they may be found in a variety of water-laid deposits where their remains are entombed and protected from bacterial decay. One of the finest preservation mediums for small insects is amber where even intracellular structures have been found intact (Poinar and Hess 1982) as well as traces of DNA.

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†P.R.I.S. Contribution No. 190.

Barthel's account of the celebrated Solnhofen lagerstaette (Upper Jurassic), which includes many insects, is now available in English (Barthel, Swinburne and Morris 1990). Table 1 lists the main insect-bearing deposits in the U.K. They are usually fine-grained rocks including mud- and siltstones, limestones, ironstones, cherts and even sandstones. In addition, subfossil insects have been found in various superficial deposits of Quarternary age such as peat (see below).

TABLE 1. The main insect-bearing strata (solid) in the U.K. Asterisk indicates not recently productive (and worth investigation?).

Palaeogene (= Lower Tertiary)	Lower Hamstead Beds Bembridge Marls 'Bagshot Beds' London Clay Woolwich and Reading Beds
Cretaceous	Wealden Series Purbeck Beds
Jurassic	Stonesfield Slate* Lias
Triassic	Rhaetic
Carboniferous	Coal Measures
Devonian	Rhynie Chert*

In the L.N.H.S. Area the London Clay has yielded material (Jarzembowski in press) and Cockerell (1920) described two species of fossil insects (Coleoptera), *Elaterites palaeophilus* and *Ceutorhynchus*? *eocenicus*. They are both from the Woolwich and Reading Beds of Peckham. Just over the southern edge of the London Area, a possible fulgoroid bug, *Cixius petrinus* Fennah, 1961, has been described from the Weald Clay (Wealden Series) of South Godstone. Working pits such as Lamb's Brickworks at S. Godstone still yield fossil insects. Unfortunately, Peckham is now a built-up area so that the only possibility of new material is from temporary exposure.

Table 2 shows the antiquity of familiar insect orders currently found in the U.K. and of a few exotic groups which occurred here in the past. Where an order has more than one group with a common name, they are given in order of appearance in the geological record. Thus moths are known from the Jurassic onwards, but butterflies are younger being first found in the Palaeogene. Giant

TABLE 2. Selected list of insect orders and their first occurrences in the fossil record.

Springtails (Collembola)	Lower Devonian
Two-tailed bristletails (Diplura)	Upper Carboniferous
Three-tailed bristletails (Thysanura in the broad sense)	Lower Devonian?
Mayflies (Ephemeroptera)	Upper Carboniferous
Giant dragonflies, damselflies and dragonflies (Odonata)	Upper Carboniferous
Cockroaches (Blattodea)	Upper Carboniferous
Earwigs (Dermaptera)	Jurassic
Termites (Isoptera)	Lower Cretaceous
Grasshoppers, crickets and locusts (Orthoptera)	Upper Carboniferous
Stoneflies (Plecoptera)	Permian
Bugs (Hemiptera)	Permian
Lice (Phthiraptera)	Palaeogene
Psocids or booklice (Psocoptera)	Permian
Thrips (Thysanoptera)	Permian
Beetles (Coleoptera)	Permian
Flies (Diptera)	Permian
Wasps, ants and bees (Hymenoptera)	Triassic
Moths and butterflies (Lepidoptera)	Jurassic
Scorpionflies (Mecoptera)	Permian
Lacewings (Neuroptera)	Permian
Fleas (Siphonaptera)	Lower Cretaceous?
Caddisflies (Trichoptera)	Permian

dragonflies (Upper Carboniferous – Triassic) were formerly placed in a separate order but have been recently incorporated in the extant order Odonata. These 'Protodonata' include the most evocative fossil insects because some of them were larger than any extant species, *e.g. Meganeura monyi* (Brongniart) had an estimated wingspan of 672 mm (Prof. F. M. Carpenter, pers. comm.). Nowadays birds like the hobby *Falco subbuteo* will take dragonflies on the wing, but in the absence of flying vertebrates in earlier periods, predatory insects would have occupied the top position in the aerial food chain. It seems that under suitable physical conditions such as the warm, constant environment of the coal-swamps and in the absence of flying predators, Odonata could evolve to the size of a modern crow (Figure 2).

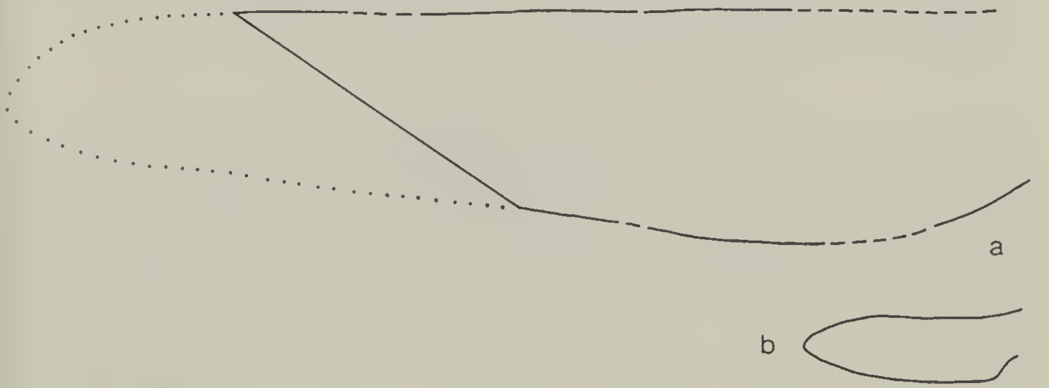

FIG. 2. Outlines of hindwings of (a) giant dragonfly *Tupus diluculum* from the Coal Measures of Derbyshire; (b) dragonfly *Anax imperator*, one of the largest living British Odonata. Wing lengths *c.*225 and 48 mm respectively. (After Jarzembowski 1988).

As might be expected, not all authorities would agree on the ordinal ranges given in Table 1: where a choice has been necessary, I have erred on the side of conservatism. Such differences are not only due to the vagaries of the fossil record, but also to alternative interpretations. A 'good' example is the age of Trichoptera (caddisflies). Sukacheva (1982) would recognise the order as commencing in the Permian. This order is considered to be closely related to the Lepidoptera (moths and butterflies) and Shields (1988) would even derive the latter from the former in the Triassic. However, this would make Trichoptera paraphyletic with respect to Lepidoptera and is unacceptable to some systematists who would not recognise Trichoptera before the separation. (For definitions of terminology, see British Museum (Natural History) 1988). Other workers point out that it is difficult to distinguish between primitive Trichoptera and the ancestral stock of Trichoptera and Lepidoptera (stem-group Amphiesmenoptera; Hennig 1981). Such workers would only recognise Trichoptera for certain in the fossil record well after they had differentiated (Cretaceous: Williams 1988). One is thus left with the origin of this aquatic order as some time between the early Permian and late Jurassic! (Wootton 1988).

However, it is interesting to note that, despite the systematic problems, there is a considerable measure of agreement in two separate recent reviews of the insect fossil record by Jarzembowski (1989) and Wootton (1990*b*). In the former reference I have cited significant works on the fossil record of major insect orders to which Rasnitsyn (1988) may be added on Hymenoptera; synopses of fossil Diptera are found in McAlpine (1981-). In addition to Sukacheva on Trichoptera, recent studies on smaller orders include Sinichenkova (1987) on Plecoptera and Willmann (1989) on Mecoptera. The fossil record of social Hymenoptera has been extended recently with the discovery of a crown group (formicid) ant in the Lower Cretaceous (Upper Aptian) of Brazil (Brandão, Martins-Neto and Vulcano 1989). McKay and Rayner (1986) have announced a new Upper Cretaceous fauna from southern Africa.

Table 2 shows that not only many familiar insect orders (or their ancestral stock) had appeared by the end of the Palaeozoic Era (Permian Period), but also the most advanced insects (Holometabola: insects with a pupal stage). One of the crucial events in the evolution of insects was the origin of flight in pre-Namurian times. No doubt future fossil finds in the *c.*70 m.y. interval between *Rhyniella* and the diverse pterygotes of the Upper Carboniferous will provide new and interesting information on this successful insect adaptation, unique amongst arthropods. In the meantime, Wootton (1990*a*) is a useful summary of the theories on the conquest of the air by insects. Another chapter in the success of the insects has been their interaction with plants and Jolivet (1986) has described their co-evolution and adaptations.*

Subfossil Insects

The value of entomology in understanding Pleistocene (Ice Age) environments is now well established. Such studies have been extended to post-glacial (Holocene/Recent) deposits where the results are not only of interest to naturalists concerned with the evolution of our present-day biota, but also to archaeologists interested in the conditions under which our ancestors lived. A bibliography of these Quarternary insects has been prepared by Buckland and Coope (1991).

In London, as in other built-up areas, new information on subfossil insects comes from two sources: temporary exposures and cores from building-sites and natural outcrops on the River Thames foreshore. There is comparatively little information on the latter because available maps do not show the geology below the Mean High Water Mark in the tidal portion.

In west London, the Thames foreshore on the Surrey side below Barn Elms is of interest because, unlike the Middlesex bank (Jarzembowski 1987), the top of the London Clay is subtidal and Quaternary deposits can be seen on the lower foreshore where the gravel, mud and rubbish thin out (Jarzembowski 1980). The most extensive horizon is a well-humified peat bed, the outcrop of which is shown in Figure 3. The peat is gyttja-like (*i.e.* transported material: the late Dr M. A. Girling, pers. comm.) and rich in well-preserved, waterlogged insect remains, especially Coleoptera. Hand-picking will reveal occasional larger individuals, including iridescent green, *cf.* Donaciinae, associated with seeds, leaves and freshwater molluscs. However, extraction in the laboratory by sieving and flotation yields a richer and more representative fauna. The top and river edge of the bed is gradually being eroded, especially by wash from passing motor-boats. The base of the peat is not exposed even on a low spring tide and the deposit is estimated to be up to 0.5m thick. Examination of larval Trichoptera remains from a preliminary core shows an upward decrease in diversity (Ms B. Wilkinson, pers. comm.) and a significant time-span may be represented.

The age of the Barn Elms Peat Bed is unknown. However, it is at the same level as the youngest (late prehistoric/early historic) and most westerly peat horizon in the Thames recognised by Spurrell (1889; the Mean Spring Low Water Mark is −1.69m O.D. (Newlyn) at Hammersmith Bridge nearby, according to the Port of London Authority). Late Pleistocene insects have been found in west London in the Colne Valley (Coope 1982) and investigation of the Barn Elms Peat Bed could provide complementary Holocene data. Also, a study of this deposit could solve an archaeological controversy. Over seventy years ago, a Trojan/Italic cup was found on the foreshore at Barn Elms (Hume

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* Also, Boucot (1990) has given a detailed summary of insect/animal interactions plus many other examples of fossil behaviour (palaeoethology), whilst Shear and Kukalová-Peck (1990) have reviewed the early history of insects and spiders.

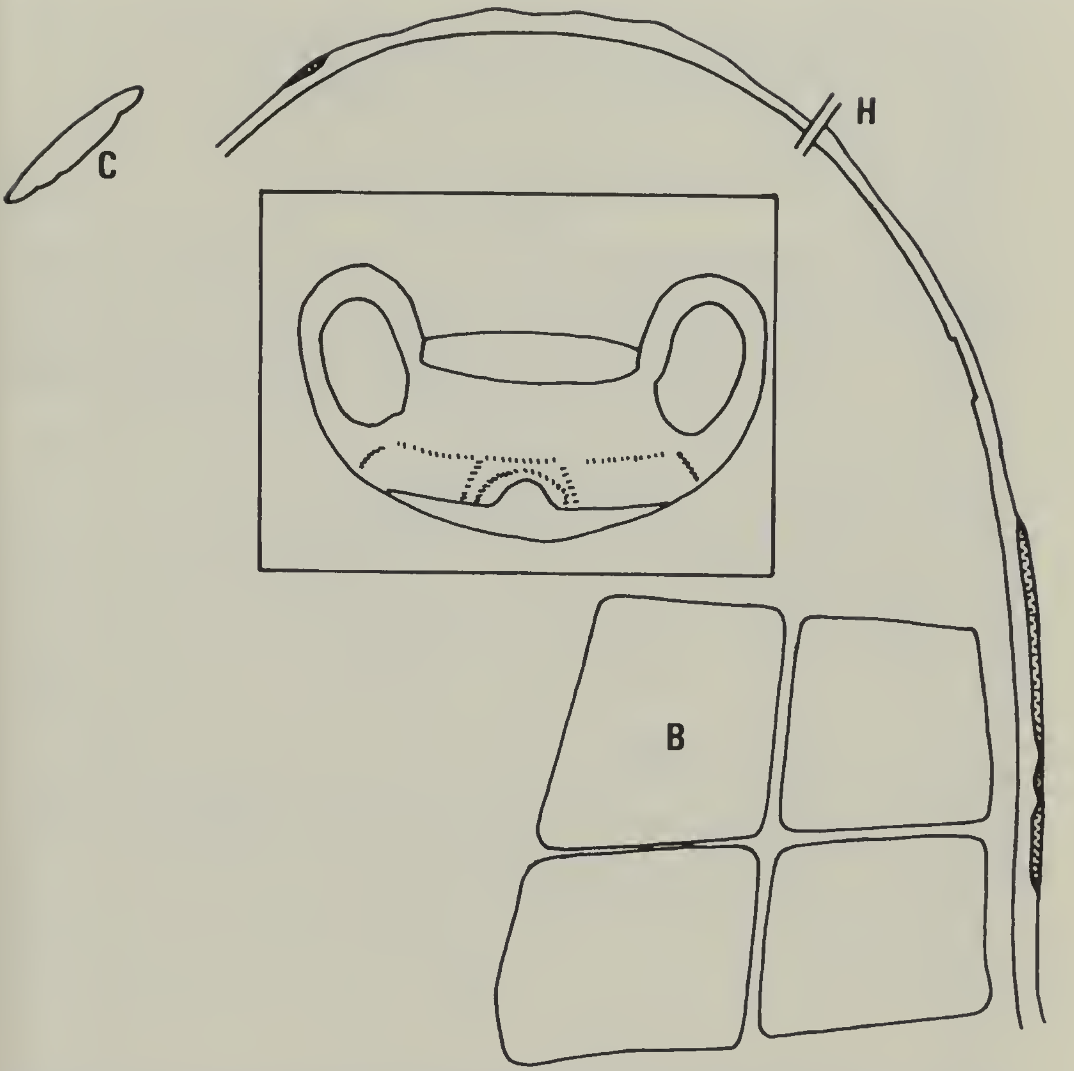

FIG. 3. Outcrop of Barn Elms Peat Bed (stippled) on R. Thames foreshore, Surrey side. Island, C, Chiswick Eyot; H, Hammersmith Bridge, B, Barn Elms Reservoirs. Inset: the Barn Elms classical cup (after Hume 1956). The reservoirs are each *c*.300 metres across.

1956). However, this rare ceramic evidence of late prehistoric contact with Classical Mediterranean civilisations has been doubted as a genuine Thames antiquity. This is because it is reported to have been found undamaged in hard gravel until exposed by a disturbance due to a boat being drawn up the shore (Hume, *loc. cit.*: 49-51). The upper part of the foreshore here is certainly gravelly below the tow-path, but a fragile piece of black pottery could have survived intact for over two and a half millenia packed in the peat below. Furthermore, the bed is readily cut by the keels of boats which are occasionally drawn over it today.

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Carr Formation and Vegetation Zones at Baldwins Pond, Epping Forest

By Alwyne Wheeler*

Summary

Baldwins Pond in Epping Forest was created in the mid-1860s. In 1989 surveys were made of the plant community, water and silt depths, and the general features of the willow carr that has become established along the inflow stream. The plant community is compared with other surveys made in 1938 and 1951-52. The changes in vegetation suggest that in this pond species richness has declined strikingly and that willow carr and *Typha*-beds now occupy about two-thirds of what had been open water in 1938.

Introduction

Baldwins Pond (also known as Baldwins Hill Pond and The Reservoir) lies near the eastern border of Epping Forest in the Parish of Loughton (TQ425975). It lies in a dammed stream which drains a major area of the northern Forest in the River Roding catchment, receiving water from Sunshine Plain and the Wake Valley Pond, both Great and Little Monk Woods, the Goldings Hill Ponds, Blackweir Hill and Baldwins Hill. The stream catchment above the pond covers some 90 hectares of Forest, most of which is woodland. Below the pond the stream (with tributaries) forms the Loughton Brook which discharges to the River Roding.

The date of construction of the pond is not certainly known and estimates have been published such as during 'the latter part of the last century' (Selby 1954: 131), the 'middle of the last century' (Qvist 1958: 31), and 'about seventy years ago' (Leutscher 1969). The pond results from the damming of the valley of the stream by The Clay Road which runs east to west through the Forest. Although no clear date for the construction of The Clay Road seems to exist, there is little doubt that it was built in 1865-66 when J. W. Maitland, then Lord of the Manor of Loughton, enclosed 1,316 acres (533 ha) of Forest within the Manor and 'began to cut roads through the very heart of the woodlands in order to develop them for building sites' (Thompson 1926: 159).

It therefore seems that the pond was formed soon after 1865-66, although it is not shown on the 1873-74 O.S. map, but does feature in the 1898 map (where it is named as the Clay Road Pond).

Because the catchment area upstream of the pond runs mostly through woodland, and many of the slopes running down to the stream are steep, both the stream and the pond receive a very heavy load of leaves, leaf detritus and, at times of heavy rain, silt. As a result the stream has become choked with detritus where it joins the pond and it has formed an advancing delta into the pond bed. Dense emergent vegetation, chiefly great reedmace *Typha latifolia*, has colonized the silt and stabilized the detritus, adding to it as it dies back annually. However, with the continuing deposition of silt into the pond bed the edge of the reedmace bed is advancing slowly into the open water. Upstream of the reedmace there is an extensive area of carr, comprised mostly of goat willow *Salix caprea* which has formed in the bed of the stream and the former northern end of the pond.

The area of the pond was given as 0.299 ha in the 1971 revision of the O.S. map which must have included much of the area occupied by the reedmace bed. When it was newly constructed the pond was probably twice the length shown on the 1971 map; it is now considerably less.

Baldwins Pond is part of the proposed flood-water retention system that is

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designed to minimize flooding in Loughton following heavy rain in the Loughton Brook catchment as happened in 1982-83. In 1989 the local authority projected that the pond's holding capacity should be increased by dredging silt from its bed. As a result of this proposal the pond and associated carr were investigated with a view to establishing the depth of silt both in the pond and in the carr. In addition, a study was made of the broad details of vegetation in both areas. The present distribution of vegetation in the pond has particular interest because it can be compared with the data published by Selby (1954) of a survey in 1951-52, and with an unpublished map of vegetation zones dating from 1938. These three surveys demonstrate the changes in the pond over a period of 51 years.

Methods

The 1989 vegetation survey of the pond was made using a dinghy and a dumpy level, with ranging poles at the edges of each plant zone. The bathymetric survey was made using the dinghy and a rope stretched across the pond at 20 m intervals from the overflow. Depths were measured, using a 3 m metal probe graduated at 10 cm intervals, every 2.5 m across the pond starting from the water's edge. A flat, pierced plate was attached to the probe for water depth measurements; this was replaced by a spike (of the same height) to measure the depth of silt. All depths were recorded to the nearest 5 cm.

In the carr, silt depths were measured with an auger in six transects at 40 or 50 m intervals up the stream. Borings were made at approximately 5 m intervals from the west bank, some variation being necessary where trees intervened. The dominant vegetation within a 2 m wide transect was noted; the girth of all trees and woody shrubs was measured at 1 m above ground level.

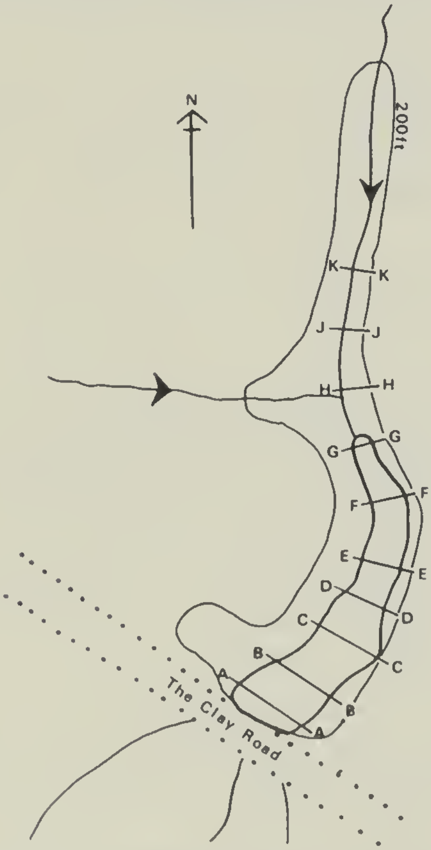

FIG. 1. Baldwins Pond. Transects of pond (AA-DD) and of carr (EE-KK). The 200 ft (61 m) contour is shown. Redrawn from the 1923 Ordnance Survey map.

The positions of the transects across the pond and in the carr are shown in Figure 1.

Selby (1954) mapped the vegetation of the pond by means of a line with coloured markers every 10 ft (3.05 m) across the pond at intervals of 10 yds (9.15 m) along the bank. Selby's study did not include information on pond depth or carr vegetation.

No information is available as to the methods used in making the 1938 vegetation map which was presented to the Centre several years ago. It was made by a science teacher as part of her course at Homerton College, Cambridge.

Plant nomenclature follows Clapham *et al.* (1962).

Results

Comparisons of major vegetation zones

The vegetation zones recorded in the three surveys are shown in Figures 2-4. Unfortunately, the outlines of the maps do not exactly coincide with one another possibly due to differences in the original map outlines in the earlier surveys. Possibly too changes in water level at the time of surveying have distorted the outlines (the 1951-52 survey may have been made when the water level was high; the 1989 survey was made during a severe drought). In addition, the overflow outlet had been reconstructed between 1951-52 and 1989 and its outline appears different between 1938 and 1951-52. However, despite differences in outline and scale in Figures 2-4, certain features (notably the bump in outline of the west bank) can be identified as common to all three.

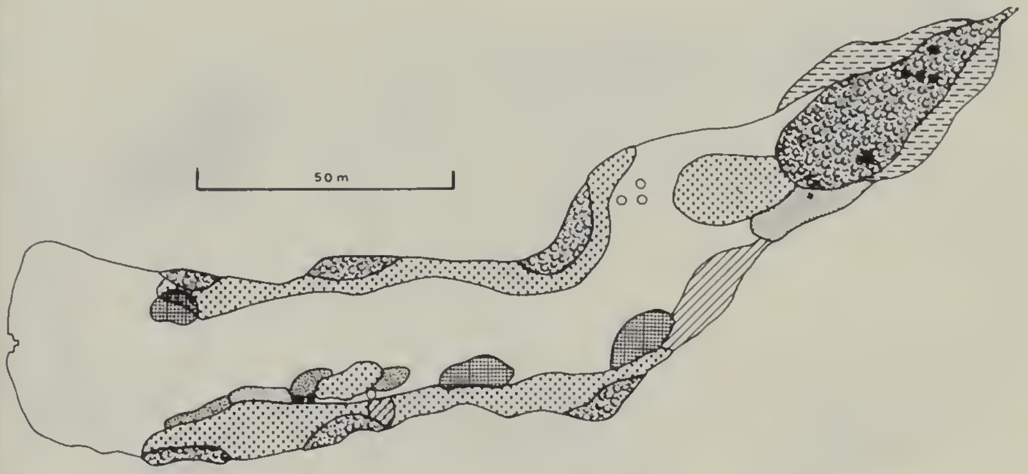

FIG. 2. Vegetation map *c.* 1938.

KEY

▦ *Glyceria maxima*
▨ *Hottonia palustris*
▩ *Typha latifolia*
■ *Nuphar lutea*
▪ *Iris pseudacorus*
▦ *Equisetum fluviatile*
▒ *Lemna* spp.
░ *Potamogeton natans*
▤ *Callitriche stagnalis*
○ *Ceratophyllum demersum*
▵ *Sagittaria sagittifolia*
▧ Overhanging trees
▤ *Salix* spp.
▩ *Eleocharis palustris*
□ *Elodea canadensis*
✶ *Butomus umbellatus*

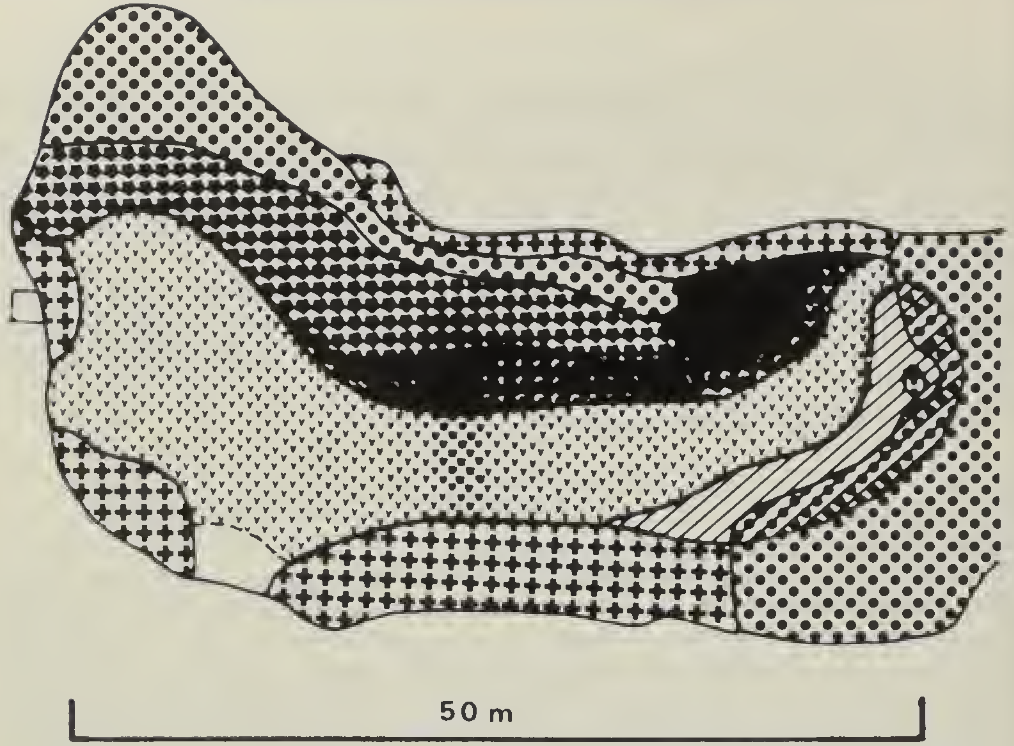

FIG. 3. Vegetation map 1951-52. Redrawn from Selby (1955). Key as in Figure 2.

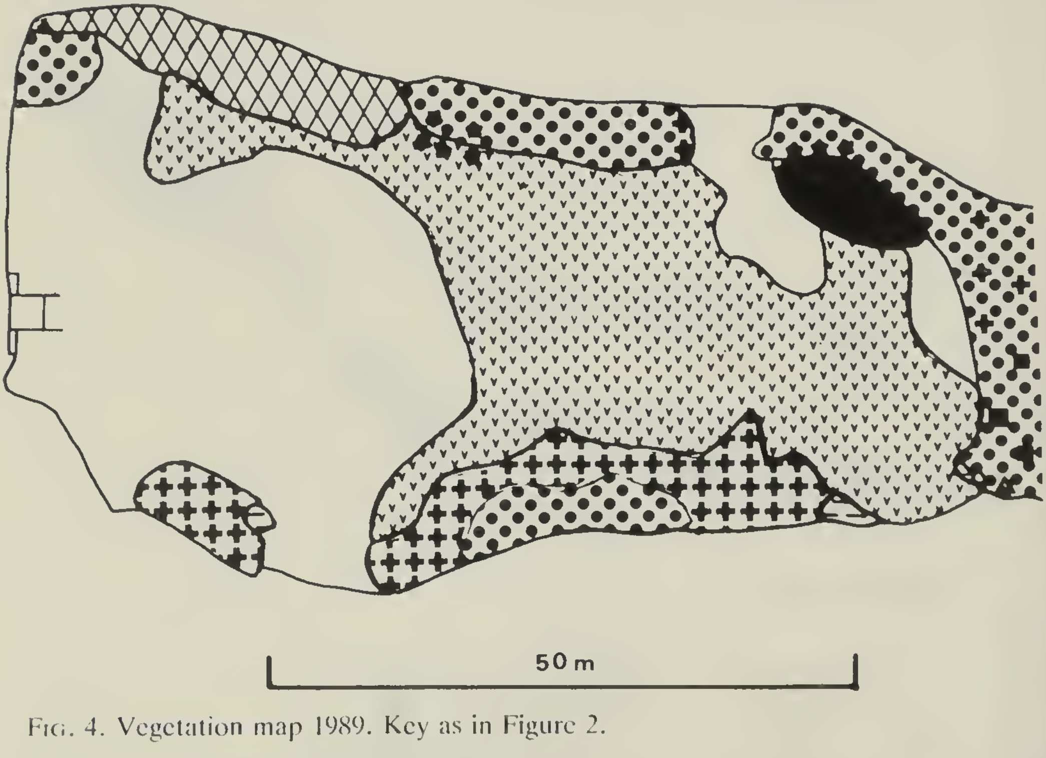

FIG. 4. Vegetation map 1989. Key as in Figure 2.

GREAT REEDMACE *Typha latifolia*

This represents the most striking change in the hydrosere. In 1938 it was shown as a small patch on the eastern bank in the northern end of the pond, but by 1951-52 it had advanced to cover most of the northern area, and there was a considerable patch filling the southeastern corner. Its distribution had advanced further to the south by 1989 into what had been open water and there were extensive beds along the eastern and western banks. However, some diminution was recorded in the southeastern corner, due probably to the extensive shade cast by bankside trees.

Compared with the advance between 1938 and 1951-52 in the main bed of the pond encroachment appears to have been slower between 1951-52 and 1989; this may be attributed to the water depth in the middle exceeding 1.25 m (with 2 m+ of silt beneath the water) whereas in the northern end of the pond the total depth only just exceeded 2 m (see Figure 7).

Water horsetail *Equisetum fluviatile*
This was not shown in the 1938 survey and may be presumed to have been absent. In the 1951-52 survey it is shown as an extensive bed on the west side of the pond in deeper water than the reedmace bed. In 1989 it occupied a much smaller area, still on the western side, but isolated as relatively small clumps.

Broad-leaved pondweed *Potamogeton natans*
In 1938 this was shown at the northern end of the pond as a small, but isolated patch, but it was also present as extensive fringes along the east and west banks. In 1951-52 it was shown as covering the whole of the central area of the pond where it was otherwise free of emergent vegetation. The 1989 survey showed that about one third of the southern end of the pond was free of this species which therefore occupied less total area.

Common spike-rush *Eleocharis palustris*
In 1938 this was shown as covering the centre of the northern part of the pond, and in several small patches on the eastern and western banks. It was not recorded in either the 1951-52 or the 1989 surveys.

Yellow water-lily *Nuphar lutea*
Not shown as occurring in 1938, but present in approximately the same place and occupying a similar area in both the 1951-52 and 1989 surveys.

Reed-grass *Glyceria maxima*
Not shown as present in 1938, but occurring in extensive beds on the eastern bank and as a narrow fringe on the western bank in 1951-52. In 1989 it was extensive on the eastern bank, but great reedmace had encroached on the bank side of the former bed, while it had been replaced on the western bank by reedmace so that it was no longer a major part of the hydrosere.

Water violet *Hottonia palustris*
Shown as an extensive bankside patch in the northeastern region of the pond in 1938. This area was overgrown by reedmace by 1951-52, but the water violet bed was shown more to the south and in a central position. In 1989 it was not mapped as a significant part of the hydrosere, although it was recorded as present.

Willow *Salix* spp. (mostly *S. caprea*)
Extensive areas growing along the banks in the northern end of the pond were shown in the 1938 map. This area was well within the willow carr by 1989. Willow-dominated areas were not mapped in the 1951-52 or 1989 surveys as they were not part of the pond community, but grew at the periphery of the pond. In 1989 there were extensive areas of willow along the northern edge inside the reedmace beds and smaller patches on the eastern bank beside the reedgrass and reedmace patches. In the northern part of the pond there was heavy growth of willow on both banks and there were small willows within the reedmace towards the centre of the bed. (These are not shown on the map.)

The Willow Carr

The most notable changes in the hydrosere between 1938 and 1989 were the striking advance of reedmace to the south and the extensive development of willow carr in what at the earlier date had been open pond (Figure 5). The reedmace beds have already been discussed.

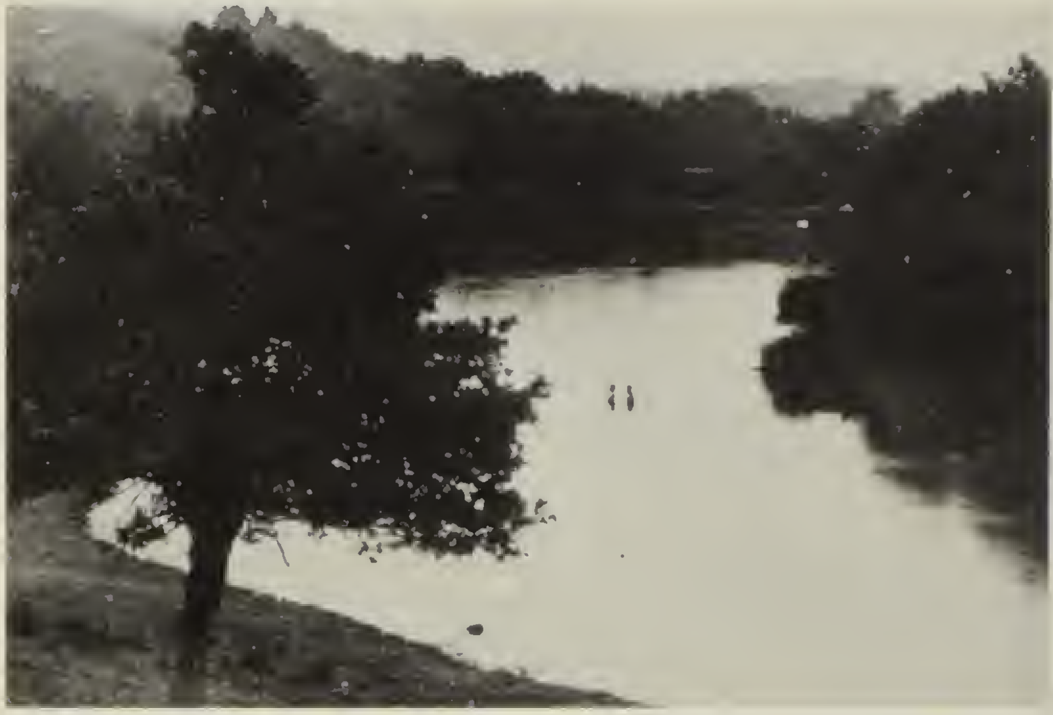

FIG. 5. Baldwins Pond. An early photograph of unknown date (possibly 1890s). The bathers are estimated to be just downstream of the present limit of reedmace. Reproduced by permission of the Passmore Edwards Museum.

The willow carr forms a distinct boundary to the north of the reedmace bed. The numbers of willows and other trees, or woody shrubs (here referred to simply as 'others') at each transect is shown in Figure 6. The other species are elder *Sambucus nigra*, hawthorn *Crataegus monogyna*, hornbeam *Carpinus betulus*, oak *Quercus robur*, birch *Betula* sp., and beech *Fagus sylvatica*.

There are a number of willows (14 out of 17 (82%)) at transect EE, the 'others' being birch (2) and beech (1). At FF there are a large number of willows (40 out of 53 (75%)), the 'others' being mostly hawthorn. At GG there are fewer willows (7 out of 13 (54%)), the 'others' being mostly elder. At HH there were 10 willows (out of 19 (53%)) the 'others' being elder (6), hornbeam (2) and oak (1). At JJ there were more, but smaller willows (15 out of 26 (57.6%)), the 'others' being elder (10) and hornbeam (1). At KK there are fewer trees, willows 14 (out of 17 (82%)), the 'others' being oak (2) and birch (1).

The girths of these trees and shrubs are also plotted in Figure 6 as distribution of girth in 20 cm classes. There is an interesting variation in willow in which the most abundant girths in EE are 20-40 and 40-60 cm, (71% total willows), in FF 53% are 20-40 cm, in GG 57% are 60-80 cm, in HH 40% are 60-80 cm, in JJ 67% are 0-20 cm, and in KK 89% are 0-20 cm.

This analysis suggests that the first two transects are in areas in which colonization by willows is relatively recent, but at GG (which lies 20+ m upstream into the carr) only a few, large trees survive. At HH similar old trees occur, but there are also a few young trees. Transects JJ and KK are dominated by thin trees, which could be interpreted as recolonization by young willows, but is a result of the older willows becoming unstable and falling, producing a crop of vertical shoots from the old wood at ground level.

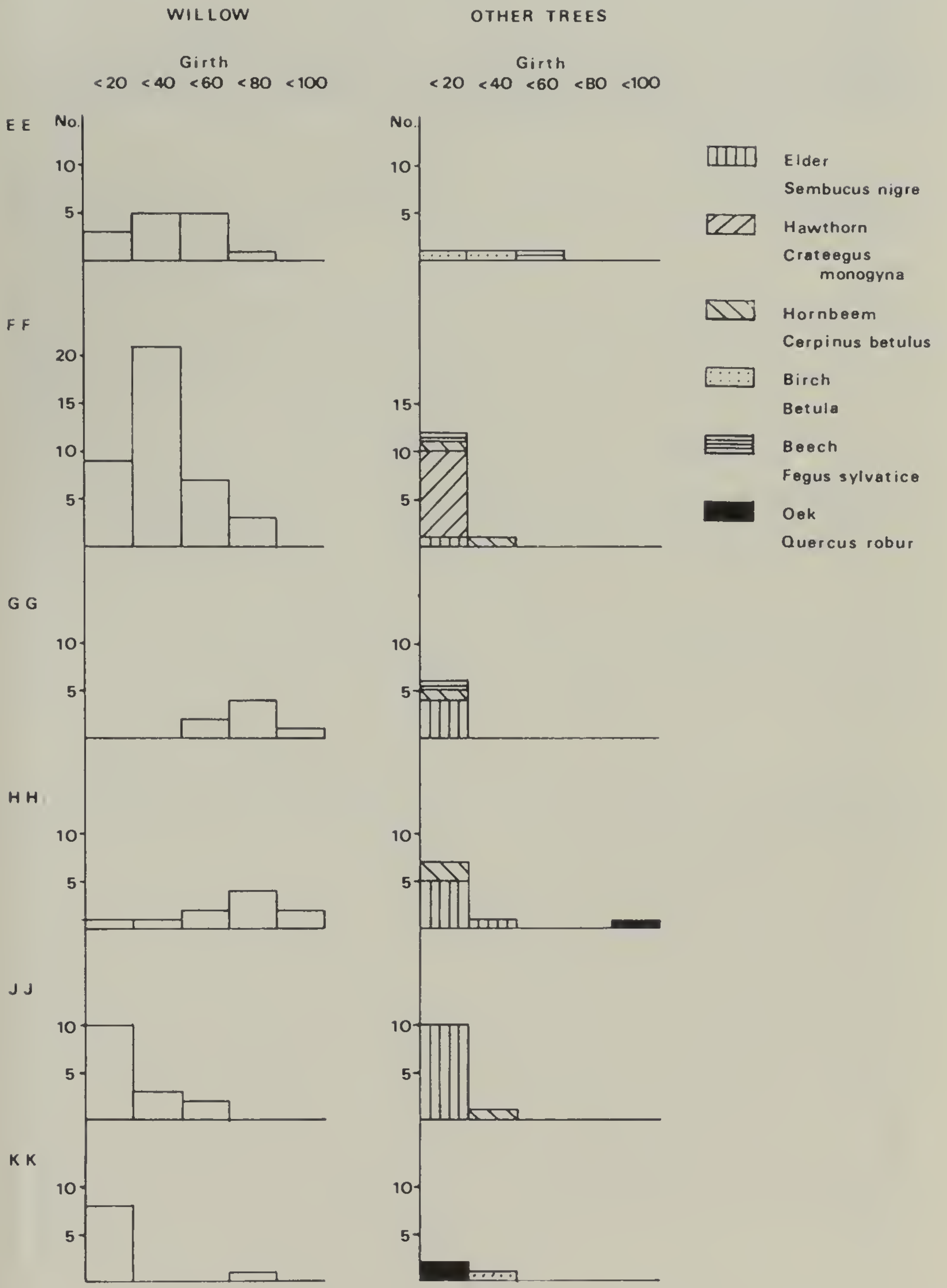

Fig. 6. The distribution of tree-girths at each transect in the carr.

The occurrence of other trees or woody shrubs in the carr is shown in Figure 6. In the six transects small birch occur in EE (2) and KK (1), beech in EE (1) and in FF and GG (1 in each), small hornbeam occur in FF (1), GG (1), HH (2) and larger specimens in FF (1) and JJ (1). Oak does not occur until transect HH and then in the 80-100 cm class (1) and in KK as small trees (2). Of the woody shrubs only elder and hawthorn occurred; elder in FF (1), GG (3), HH (5) and JJ (10) and hawthorn only in FF (9). *Rubus* sp. increases upstream in the carr, but was not quantified in the survey.

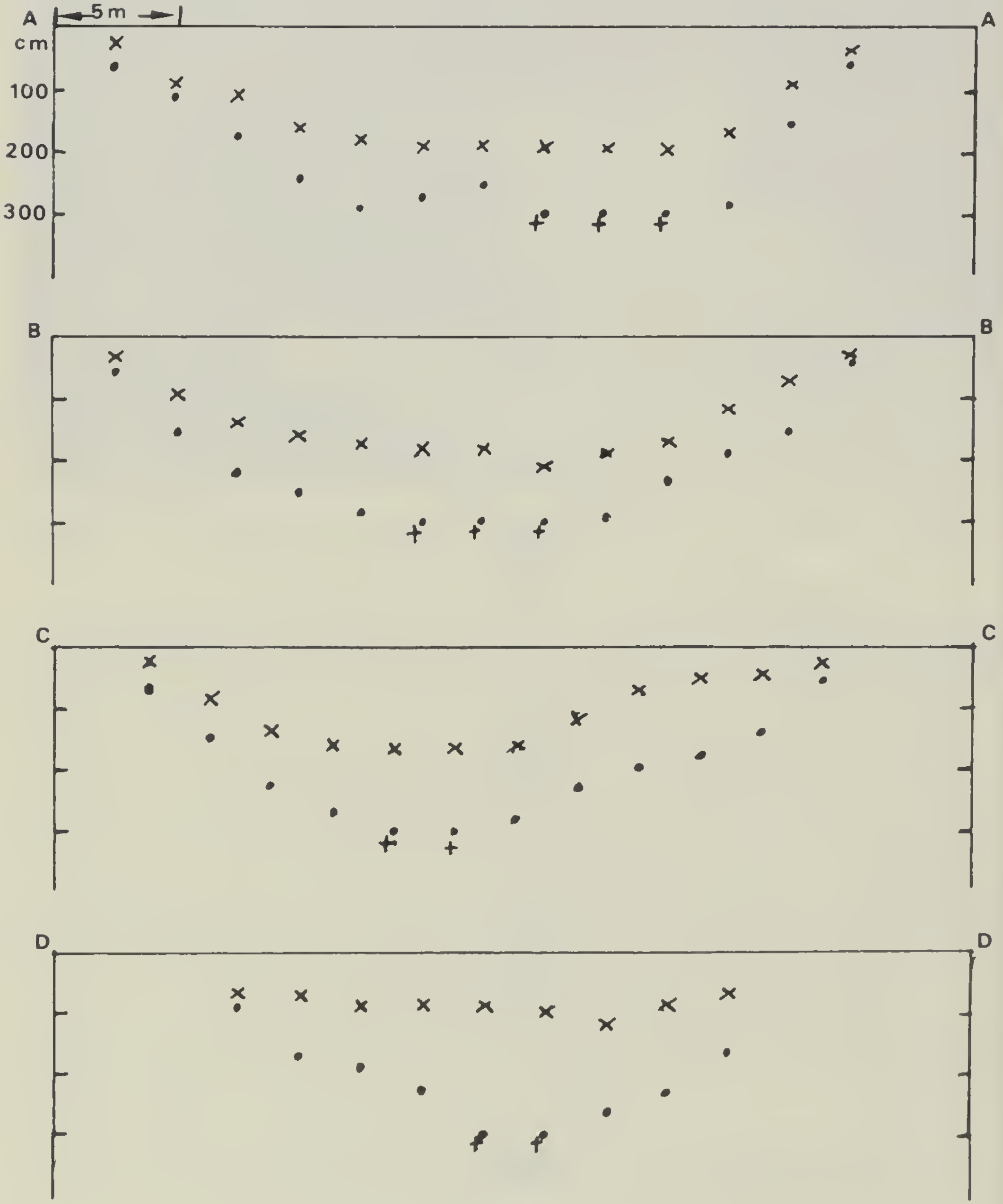

FIG. 7. Depth of water and of silt in Baldwins Pond in August 1989. Due to drought the water level was 22 cm below the sill depth.

Silt Deposition and Water Depth

The series of transects across the pond and the carr were designed to measure the amount of silt that had been deposited in the 100+ years of the pond's existence.

The bathymetric survey results for the pond are shown in Figure 7, the upper line showing water depth at the time of the survey and the bottom line showing silt depth down to a combined water + silt depth of 3 m. In all the pond transects two or three soundings exceeded 3 m; these are shown with a plus sign. The results are plotted either side of a hypothetical mid-line in both pond and carr. Transect positions and spacing are shown in Figure 1. At the time of the survey the water surface was 22 cm below the top of the overflow sill; therefore depths must be increased by this much to correct this. The true (full) surface is shown as a dotted line in Figure 7.

At the southern end of the pond (transect AA) there is in excess of 1 m of silt at five out of 13 sampling points. (Two more which are less than 1 m may represent discontinuities in the pond bed and are probably artefacts, for example, a sunken, water-logged tree-trunk.) At BB there are five samples with a minimum silt depth of 1 m. At CC, although the pond bed is more shallow generally, there is a notable increase in deposited silt with seven samples out of 12 with more than 1 m of silt; this represents 15 m of the width of the pond bed. At the most northerly transect (DD) silt depths are greater, seven (out of nine) sites being in excess of 1 m, and two being greater than 2 m. This is not unexpected as this section of the pond is adjacent to the reedmace bed and the beginning of the carr. Likewise, water depths here are generally around 1 m, considerably less than elsewhere in the pond.

The transition between water and reedmace bed was sudden. In August 1989 the water was exceptionally clear and the surface still and it was possible to see the silt slope clearly to a depth of 0.7 m. The slope was almost straight and made an angle of *c.* 45°. Unfortunately any attempt at accurate measurement was frustrated by the cloud of silt disturbed.

Within the carr, depths of silt of, or exceeding, 2 m continued to be recorded at transects up to 120 m upstream from the reedmace bed. Close to the edge of the reedmace (transect EE) two out of four samples were of over 2 m; at FF one out of four exceeded 2 m and two others were close to 2 m. At GG one sample of silt of 2.5 m was recorded and another of 2 m, and similar maxima were recorded at HH and JJ. At KK the maximum silt depth measured was 2 m, but here the base of the valley had narrowed to around 15 m width.

Although during the period of the 1989 survey there was no surface water running in the stream the course of the stream bed was clearly visible (its position is given in Figure 8). Two aspects of interest were noted. At EE where it entered the reedmace bed it had divided into two courses. Eighty metres above this (at JJ) there were again two stream courses, but at all other transects there was only a single stream. It must be presumed that the stream course is variable, bifurcating around obstructions and then amalgamating into a single stream. The second interesting point was that in most cases the stream course followed one bank of the valley or the other, the only exception being at EE, nearest to the reedmace bed, where the stream flowed through the bed not at its edge. This is shown in Figure 8 where the first auger boring of each transect was made on the bank-side of the stream course.

Some descriptive notes were made on the texture of the silt in the carr, but the soil was not analysed. Closest to the reedmace bed (EE) one sample had 10 cm of loose leaf-litter on the surface, all the others (three) were black anaerobic mud from the surface down. At FF there was 15-30 cm of loose silt at the surface, then black anaerobic silt, increasingly compacted. At GG there was 15-40 cm of friable, brown loam then fibrous (near the surface) anaerobic

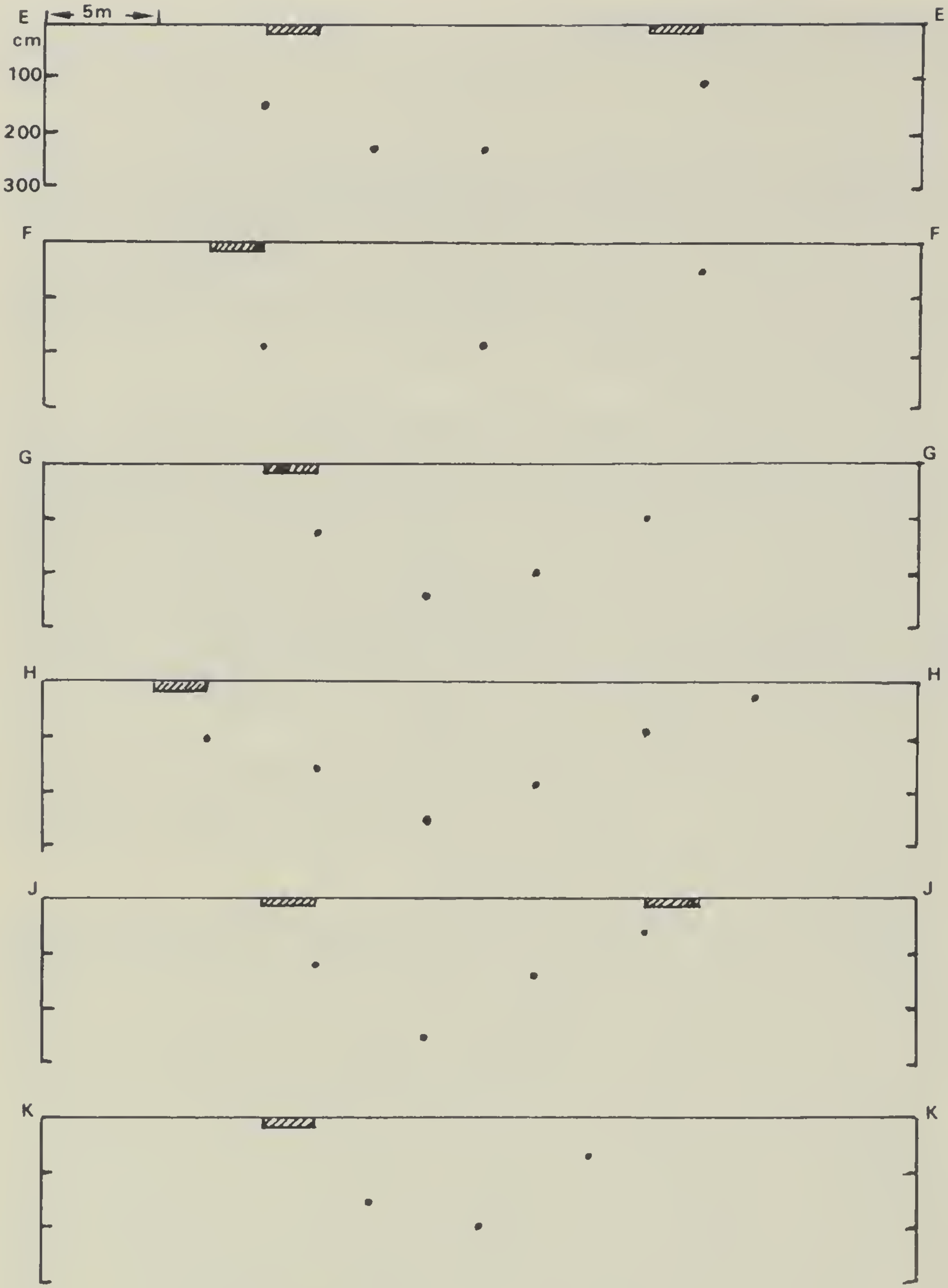

FIG. 8. Depth of silt in carr (1989).

black silt. At HH the friable, brown loam varied from 0-40 cm and overlay organic black silt, anaerobic in several samples. Similar conditions were recorded at JJ and KK with the friable, brown loam depths ranging from 15-40 cm.

Discussion

During the 100-125 years since Baldwins Hill Pond was formed following the construction of The Clay Road, its form has changed very significantly. Comparison of the area of open water today with that in early photographs

(Figure 5) shows that it has diminished by more than half. This is confirmed by the vegetation map of 1938 in which open water and aquatic vegetation are shown to extend to the north where the pond bed narrows. By 1951-52 open water and aquatic plants occupied about one third of the open area of 1938, and by 1989 had further diminished in area.

Siltation of the original pond bed by leaves, detritus and silt from the upstream valleys and hillsides has resulted in an average maximum of 2 m of silt in the northern part of the pond. As the silt has deposited and built up it was colonized by common spike-rush, yellow flag *Iris pseudacorus*, and reedmace, and initially at the edges of the pond, by willow (1938). By 1951-52 reedmace appears to have been the major colonizer of open water with horsetail and reed-grass, with willow in the mature reedmace beds upstream (Selby 1954: 131-2). By 1989 the eastern and western edges of the pond had extensive reed-grass and reedmace closer to the bank (where it was in places being shaded out by willows). At the northern end a dense bank of reedmace bordered the willow carr. Much of the area mapped in 1938 as open water, or the broad-leaved pond-weed, common spike-rush and iris communities was now covered by willow carr and reedmace.

Although it is not possible to give measurements for the rate of colonization between 1938 and 1951-52, and 1951-52 and 1989 because of the differing scale of the maps and their unknown accuracy, it seems that the increase of reedmace and carr was fast in the 14 years between 1938 and 1951-52, but was distinctly slower in the following 37 years. It has been suggested that some dredging took place in this period (Leutscher 1969); physical features of the pond may account for this. The pond is wider to the south and there is thus a greater surface area to colonize. More importantly, the depths recorded in the carr and the pond show that the northern end of the original pond had depths of 2 to 2.4 m, while the southern part is much deeper, often in excess of 3 m (this is in agreement with expectations as the valley of the stream is deeper still on the other side of The Clay Road). Silt would therefore accumulate more slowly due to the greater width and the advance of the reedmace into the pond will slow down due to the deeper water. However, by 1989 extensive growth of willow had formed behind the reedmace beds on the eastern and western banks which suggests that siltation and colonization will now proceed in both of the surface dimensions.

The major vegetation zone to the north of the pond is now the extensive willow carr which has developed for more than 150 m upstream of the present reedmace. Above 150 m the stream narrows and the development of carr is negligible. The size of the carr willows has already been discussed (see Figure 6) and it follows what seems to be a logical sequence with the younger (*i.e.* thinner) trees downstream close to the reedmace bed, with larger, but fewer, trees about 30-60 m upstream. The reappearance of thin trees (*i.e.* 20 cm girth) at 90 and 120 m is due, not to fresh colonization, but mainly to the new shoots arising from the original now old and fallen willows.

The narrowness of the valley, the relative shortness of the carr, and possibly the relatively short time-scale of the colonization of this pond (at most 100 years) makes it difficult to detect any major progression from willow carr to secondary woodland. However, the presence of small hornbeams at transects 20-80 m into the carr and small oak at 150 m may suggest that some move to secondary woodland is taking place. The notes made on the carr soil show that not until 50 m into the carr (GG) was there any significant layer of loam (40 cm) overlying the anaerobic black silt and this coincided with the appearance of significant numbers of elder in the carr.

The plants recorded in the pond show several differences in frequency over the period 1938-1989. The changes have been discussed earlier, but several of the more interesting can be highlighted. Two species seem to have declined in numbers. The common spike-rush was apparently very extensive in 1938, was recorded as rare in the reedmace community and only locally abundant in the horsetail-reedmace community by Selby (1954). It was not recorded in 1989. Water violet was shown as covering a considerable area in 1938, was recorded as frequent on the boundary of the reedmace community in 1951-52 and again covered a large area. It was recorded, but was not present, in a significant area in 1989. This species has declined in other ponds in northern Epping Forest in the last 25 years and, over a 50-year period, throughout the Forest. There is less clear evidence for change in the flowering rush *Butomus umbellatus* which was present as a small patch in 1938, was not recorded in 1951-52 and although it was recorded in 1989 it did not form a significant member of the community. This species has also declined in several ponds in the Forest over the same period.

Other plants have either increased their abundance or have appeared since the 1938 survey. The broad-leaved pondweed covered a moderate area along the margins and at the northern end of the pond in 1938; it covered a large surface area in 1951-52, but in 1989 had retreated from the southern end of the pond. Possibly the depth of water in the main body of the pond in 1938 was too deep for it to thrive (at least 3 m +), but this is less than the maximum length of the stem of 5 m recorded by Clapham *et al.* (1962). Water horsetail was not recorded in 1938; occupied a large area in 1951-52, but seems to have declined since. Reed-grass appears to have followed the same pattern. Finally arrowhead *Sagittaria sagittifolia* was recorded in a small clump in the northeastern corner of the pond in 1989; it was not mapped or listed by Selby (1954), nor was it shown as present in 1938.

Although no extensive quantitative study of the plants in the hydrosere was prepared for Baldwins Pond in any of these surveys there do appear to have been several changes in the area occupied by certain species, in addition to the dramatic development of reedmace and willow carr over the last 51 years. On balance, most of these have been negative with the decrease of several species which are locally uncommon. Probably most of these changes are due to succession as silt accumulates and the open-water area diminishes. While the evidence for this is clear in the case of reedmace and willow, it is suggested that species richness of the pond is decreasing overall, a process that will eventually result in the formation of willow carr. However, the carr itself is a valuable habitat, and this is the best example in the Forest. Unfortunately its development has been at the inevitable expense of the open water communities. Possibly in terms of management, it would be desirable to halt, or even reverse, the succession by clearances of reedmace and carr, but there would have to be clear justification for the sacrifice of one habitat in favour of the other.

Acknowledgements

I thank my colleagues and former colleagues at the Epping Forest Conservation Centre, Nick Sanderson, Jont Bulbeck, Jez Elkin and Matthew North – who all got wet or muddy (often both) during the fieldwork and also Patricia Moxey for help in the field and for advice. Jo Daley redrew the maps with great patience and care, Sita Fonseka typed from my manuscript with her usual accuracy; I thank both of them for their help. I acknowledge with thanks Paul Moxey, Warden and Director of Studies at the Epping Forest Conservation Centre, for his advice and for making available space and facilities.

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Observations on the Plants of an Intermittently Polluted, Spring-fed Pool Flowing into the Thames

By David M. John, Leslie R. Johnson and Jenny A. Moore*

This paper is dedicated to the memory of the late Dr Martin Morgan-Jones, Environmental Controller (West) of the former Thames Water Authority, who introduced us to this fascinating habitat and contributed much to bringing the study to a successful conclusion.

Abstract

Blue Pool, near Stanford Dingley, Berkshire, is fed by artesian springs (Kimberhead Springs) that rise in the Pang Valley and flow into a minor tributary of the River Thames. Since the early 1970s the clear bluish-coloured water of this renowned local beauty-spot has frequently become turbid following heavy rainfall. These turbidity episodes have increased in frequency and duration over the 1980s and are associated with contamination of the pool water by coliform bacteria. The actual source of pollution of the aquifer remains uncertain, but drainage of contaminated water into nearby swallow-holes is implicated. Changes in its aquatic plants have been followed over a four-year period, 1986-1990. During the first six months of the study, July-December 1986, the pool vegetation was dominated by angiosperms, mosses and filamentous green algae. The decrease in cover of the principal dominants over this period in this very stable environment is related to changes in the ambient light conditions. In February 1987 filamentous diatoms first developed in quantity and dominated the vegetation for the remainder of the study. These diatoms blanketed much of the pool bed, persisted throughout the year, and inhibited the growth of other aquatics. Discussed are various factors that might account for the continued domination of the pool vegetation by diatoms.

Introduction

Natural artesian springs with a permanent flow are uniquely stable aquatic habitats that discharge directly into a stream channel or pond. They are widely distributed and usually have a limited, but somewhat distinctive, fauna and flora associated with them. Due to the stability of a spring environment any seasonality exhibited by its biota is often attributed to external factors, *e.g.* light climate, likely to be important at higher latitudes. Springs thus represent ideal natural laboratories deserving of more attention than they have received hitherto. Studies have tended to focus on hot geothermal springs and consequently more is known of this spring type than the commoner non-thermal springs. In both types the flora is commonly dominated by blue-green algae (Castenholtz and Wickstrom 1975, Golubić 1967, Pentecost 1990), but diatoms are known to play an important role in some temperate springs (Round 1957, 1960). Only in the immediate vicinity of the source can the flora be considered truly a 'spring flora'. For this reason Round (1981) draws attention to the necessity to sample as close as possible to the source of a spring when studying its algal flora. Most studies on springs have been directed towards understanding the environment close to the source rather than in the spring-fed ponds where conditions more closely resemble those found in deep streams.

Studies on the algal flora of springs in the British Isles and mainland Europe are few (Golubić 1967, Hudson *et al.* 1971, Round 1981) and information is lacking on the effects of pollutants entering spring-fed pools on the aquatic vegetation. This paper presents the findings of a study of a spring-fed pool in the Pang Valley, namely Blue Pool (SU583715), and is an extension of one commissioned by the Thames Water Authority that was designed to assess the effects of intermittent episodes or pulses of pollution on its flora. The principal

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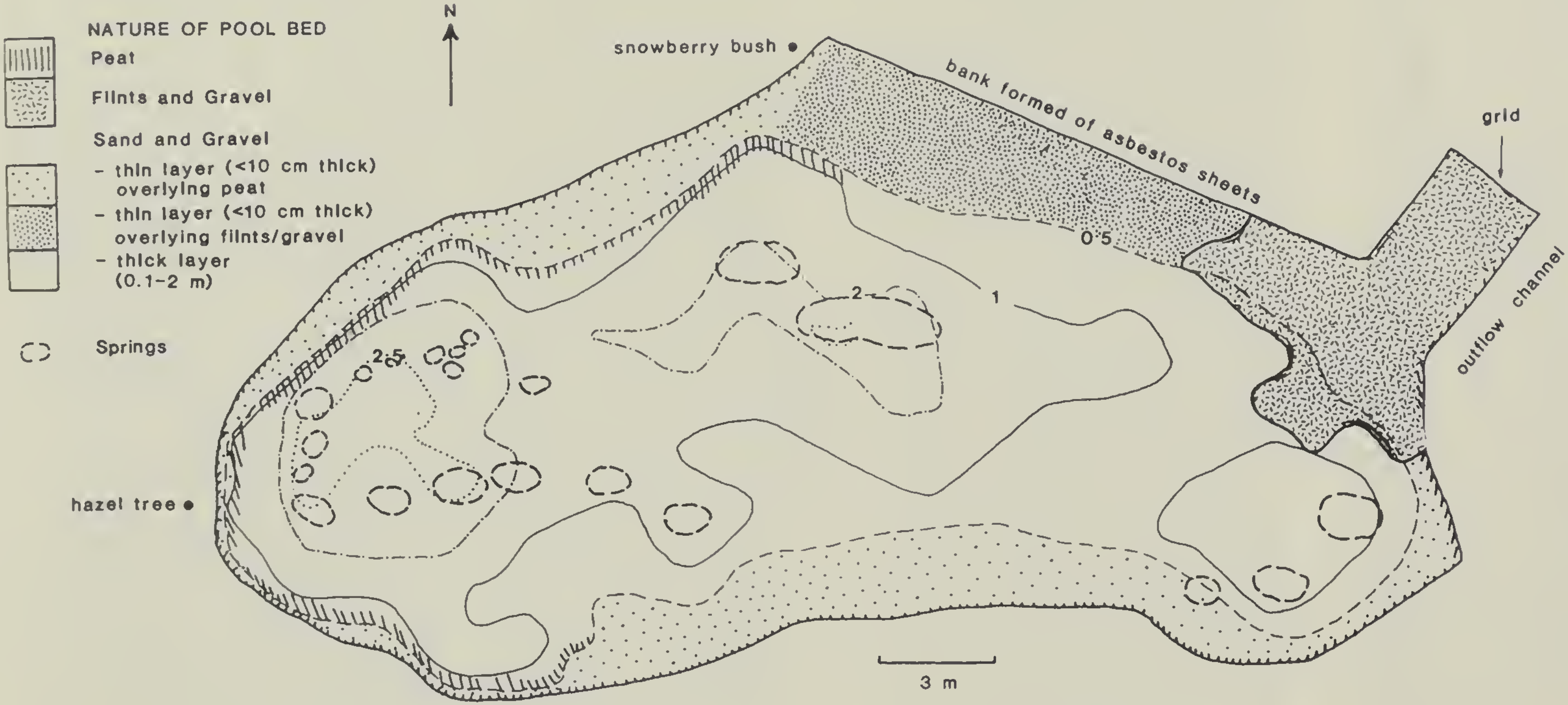

Fig. 1. An outline map of Blue Pool showing bathymetry (m). the areas of moving sand which denote the position of springs, and composition of its bed.

objectives of the present investigation on the aquatic plants of Blue Pool were (a) to describe its composition and seasonality, and (b) to determine whether significant changes have taken place in response to intermittent contamination of its water supply.

Description of the Study Site

Kimberhead Springs, one of a series of artesian springs in the Pang Valley (near Stanford Dingley, Berkshire), discharge along a wide channel into a minor tributary of the River Thames known as the Pang. These springs feed a number of disused watercress beds and give rise to a pool known locally as Blue Pool (Figure 1). The pool is believed to have been enlarged in medieval times to give a greater supply of water and, more recently, for the breeding of trout. It is a well-known local beauty-spot renowned for its clear, blue water and fine specimens of brown trout. To enhance its attractiveness the local landowner periodically removes unsightly skeins of filamentous algae and excessive growths of aquatic angiosperms. A steel hand-rake is used to remove plants from the shallows whilst in deeper water they are dislodged by dragging a heavy chain or small-mesh wire net across the bed of the pool. A cutter similar to a commando saw was used in December 1987 for removing the rooted aquatics and proved a most effective tool for the purpose.

Blue Pool is nearly twice as long as broad (18 m wide, 33 m long) with its main axis lying in a northwest-southeast orientation. Its maximum depth is 3 m (mean depth: 1 m) and its volume estimated to be *c.* 400 m^3. About 20 springs feed the pool, with at least half of these located in the deeper western basin (see Figure 1). The shallow ledge and bank along the northwest and south sides is composed of peat overlain in most places by fine sand. Most of the pool-bed consists of sand and sediment which is *c.* 2 m deep between the western and southwestern basin. Below this unconsolidated material there seems to be a layer of flints similar to those that floor the outfall channel. A barrier of asbestos sheeting along much of the northeastern side of the pool restricts outflow to a channel only 2 m wide and about 0.5 m deep.

A number of newspaper accounts extolling the beauty of the pool exist (*e.g. Evening Gazette* 1937) and these mention the striking blue colour and clarity of its water. Evident turbidity of its water was first noticed by its owners in 1973 and 1974 (Mr and Mrs Emm, pers. obs.). These turbidity episodes have increased in duration and frequency over the 1980s and normally take place several hours after the onset of a prolonged period of heavy rainfall.

Material and Methods

The flora and abiotic environment of Blue Pool were investigated from July 1986 to March 1990. A grid survey was carried out at the beginning of the investigation to map the main morphometric features, position of areas of moving sand (location of springs), different bottom types, and the distribution of the principal stands of vegetation. Changes in the distribution and cover of the vegetation were followed on subsequent occasions by comparing maps. Much of the rooted vegetation was removed manually in October 1986 and did not re-establish again in any quantity during the study. Visits were made at monthly intervals for the first year of the investigation and less frequently as its flora became dominated by prolific growths of diatoms. Macrophytes were sampled by wading in the shallows or by snorkel-diving in deeper water. Small benthic algae were studied using polystyrene petri-dishes left in the pool for about one month and then collected for microscopic examination. A plankton net was used to sample any free-floating algae. All algal specimens collected during the study are deposited in the Herbarium of the Botany Department at The Natural History Museum, London.

Water samples for analysis were collected in 2-litre plastic bottles. Every attempt was made to collect some samples as close to the source of the springs as possible. Preliminary measurements demonstrated movement to be sufficient to prevent stratification of the water. Temperature and pH were measured just below the surface. Discharge was measured on five occasions in the outflow channel by following the rate of movement of a floating object over a predetermined distance. Oxygen saturation was measured in July and August 1986 and water was collected for chemical analysis on 15 occasions in 1986 and 1988. Chemical analysis was carried out by the Thames Water Authority. Bacteriological analysis was performed on water samples collected before, during and immediately following periods of high turbidity. These analyses were carried out by the Thames Water Authority, The Newbury District Council, and by Lyne, Martin and Radford (Analysis and Consulting Service Society).

Results

The Physico-Chemical and Bacteriological Environment

The water is very hard, moderately well oxygentated, and contains moderate levels of plant nutrients including nitrate-nitrite nitrogen and silica (Table 1). Over the investigation temperature and pH varied within a narrow range, 10.0-10.7°C and 6.8-7.6 respectively. On many sampling visits the pool water was to varying degrees cloudy or turbid and in the deeper basin its bed was not visible. The data were too incomplete to determine whether water chemistry changes correlated with turbidity. There was apparently a significant increase in conductivity and total nitrogen between 1986 and 1988 when the data for the two years are compared. There is some indication of an increase in silica over the same period and a reverse trend in hardness, alkalinity and sulphate. A

TABLE 1. The means and ranges (in parentheses) of the results for oxygen, chemical and bacteriological analysis of water collected in 1986 and 1988.

	1986	**1988**
pH	7.09 (7.0-7.3)	7.02 (6.8-7.6)
Conductivity (μsic cm^{-1} @ 20°C)	521 (483-551)	601 (595-613)
Total oxidised N (mg l^{-1})	5.6 (5.2-5.9)	6.5 (5.9-6.7)
Silica ($Si0_2$ mg^{-1})	15.6 (15.2-16.25)	16.7 (15.4-18.5)
Orthophosphate (P mg l^{-1})	(<0.02-0.06)	(<0.02-0.06)
Chloride (Cl mg l^{-1})	17.1 (16-18)	18.25 (16-20)
Sulphate ($S0_4$ mg l^{-1})	24.3 (19.8-29.1)	21.2 (15-27)
Hardness ($CaCO_3$ mg l^{-1})	305.1 (284-324)	278.4 (266-289)
Alkalinity ($CaCO_3$ mg l^{-1})	252.9 (210-234)	225.8 (222-231)
Oxygen* (mg l^{-1})		
– western basin	(5.65-6.5)	
– outflow channel	(11.4-11.75)	
– amongst aquatics	(7.85-7.95)	
Presumptive *E. coli* (maximum counts 100 ml^{-1})	12,000	434
Total coliforms (maximum counts 100 ml^{-1})	–	1,030

*measured in July 1986

relationship exists between the presumptive *Escherichia coli* counts and turbidity. The findings (Figure 2) are confirmed by data collected on several occasions between April and September 1988. Some of the results for the bacteriological analysis are presented in Table 1.

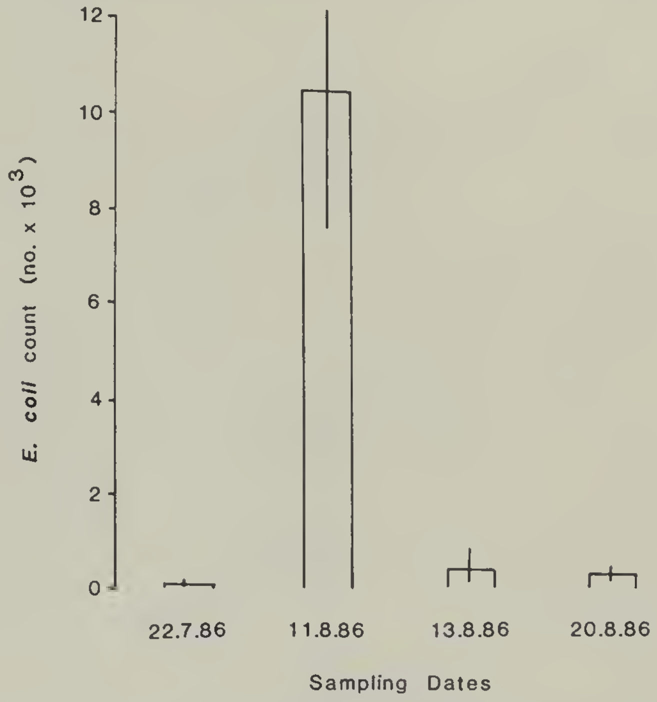

FIG. 2. The mean counts and ranges of the coliform bacterium *Escherichia coli* as measured in 1986 when the water was very clear (22 July), very turbid (11 August), and clearing (13 and 20 August).

Flow rates were measured at regular intervals from July to December 1986 and ranged from 8.8-10.75 $m^3 min^{-1}$ (see Table 1). Over this period flow varied by no more than about 8% of the mean and the water level fluctuated by less than 3 cms. Turnover time is calculated to be about 40 minutes assuming an average outflow rate of about $10^3 m\ min^{-1}$. The oxygen saturation measurements carried out in 1986 showed the pool to be fairly well oxygenated with the highest values amongst the beds of submerged aquatic plants and within the outflow channel (see Table 1).

The Phytobenthos

Seven aquatic spermatophytes were recorded in the pool with *Lemna minor* seen on but few occasions. During 1986 the stands of vegetation were usually dominated by one or other of the rooted spermatophytes, but occasionally co-dominated by two or three species (Figure 3). Two bryophytes, seven spermatophytes and 67 algal taxa were detected (Table 2).

Seasonal and Spatial Distribution: 1986

The rooted angiosperms present at the beginning of the investigation (July 1986) in order of cover abundance (Table 3) were as follows: *Potamogeton natans*, *Callitriche stagnalis*, *Ranunculus* sp., *Elodea canadensis*, *Rorippa nasturtium-aquaticum* (Figure 3). Stands of these plants were confined to deeper areas with only the occasional clump or individual growing on the shallow marginal ledge where the water was less than 0.2 m deep. The shallows away from the outflow channel were either bare of vegetation or covered with flocculent growths of filamentous green algae, principally *Spirogyra*. Rooted plants were absent from

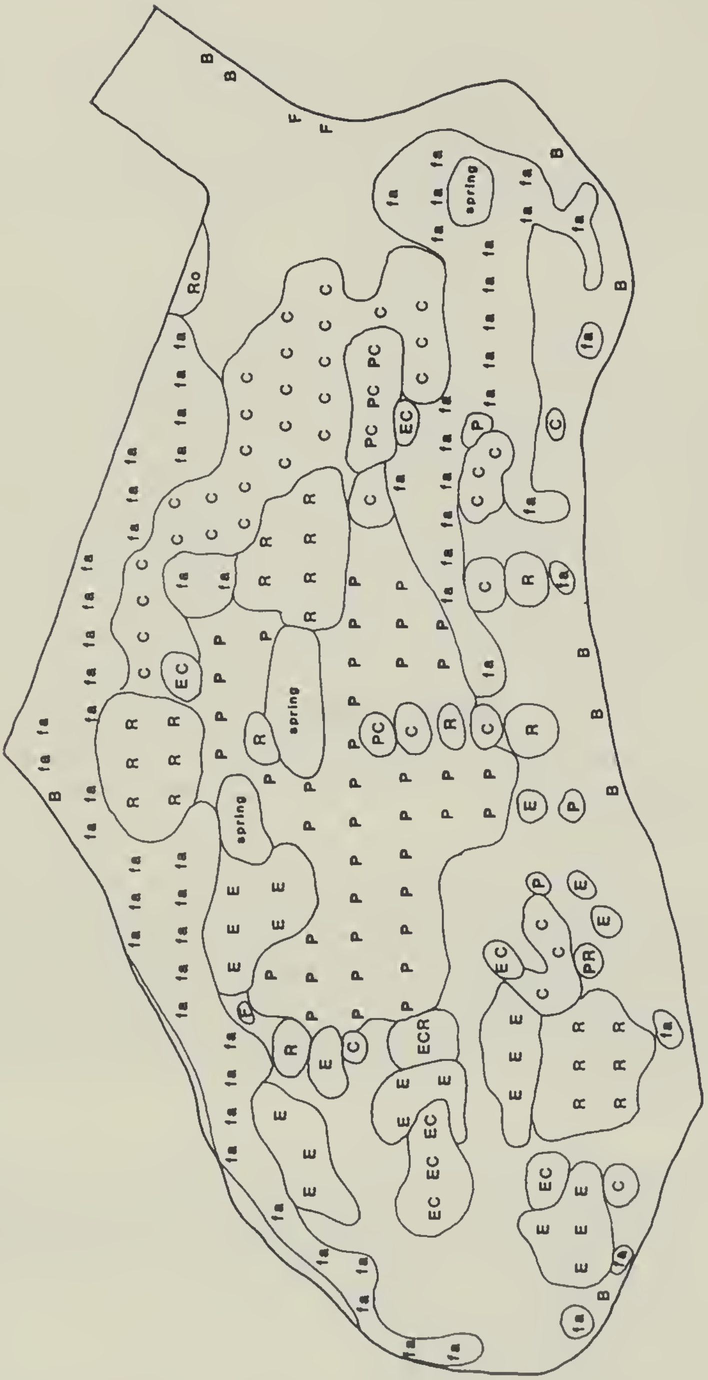

FIG. 3. Outline map of Blue Pool showing the distribution of stands of benthic plants in July 1986.
Key to letters: B, *Batrachospermum*; C, *Callitriche*; E, *Elodea*; F, *Fontinalis*; P, *Potamogeton*; R, *Ranunculus*; Ro, *Rorippa*; fa, filamentous algae.
Two or more letters indicate a mixed stand; letter order indicates decreasing cover abundance (left to right).

Table 2. A full list of all the aquatic plants observed in Blue Pool during the study period.

Spermatophytes

Callitriche stagnalis Scop.
Elodea canadensis Michx.
Lemna minor L.
L. trisulca L.
Potamogeton natans L.
Ranunculus species
Rorippa nasturtium-aquaticum (L.) Besser agg.

Bryophytes

Cratoneuron filicinum (Hedw.) Spruce
Fontinalis antipyreticum Hedw.

Algae

a. Chlorophyta (Green algae)
Aphanochaete repens A. Br.
Chaetophora elegans (Roth) Ag.
Draparnaldia mutabilis (Roth) Cedergren
Gongrosira incrustans Kunz.
Microspora pachyderma (Wille) Lagerh.
Oedogonium spp. (3 size categories recognised)
Protoderma viride Kuetz.
Rhizoclonium hieroglyphicum Kuetz.
Scenedesmus obliquus (Turp.) Kuetz.
Spirogyra spp. (5 size categories recognised)
Ulothrix subtilis Kuetz.
Ulothrix sp. (aff. *U. zonata/U. rorida*)
Uronema confervicolum Lagerh.

b. Xanthophyta (Yellow-green algae)
Tribonema viride Pasch.
T. vulgare Pasch.
Vaucheria sp. (aff. *V. geminata*)

c. Rhodophyta (Red algae)
Batrachospermum atrum (Huds.) Harv.
B. moniliferum Roth
Chantransia-stage of *Batrachospermum*

d. Cyanophyta (Blue-green algae; =Cyanobacteria)
Chamaesiphon incrustans
Hydrococcus cesatii Rabenh.
H. rivularis Kuetz.
Lyngbya kuetzingianum Kirchn.
L. kuetzingii Schm.
L. lagerheimii (Moeb.) Gom.
Oscillatoria amphibia Ag.
O. amphigranulata van Goor
O. chlorina Kuetz ex Gomont
O. irrigua Kuetz.
O. limosa Ag.
O. quadripunctata Bruhl & Biswas
O. tenuis Ag.

e. Bacillariophyta (Diatoms)
Achnanthes lanceolata (Bréb. ex Kuetz.) Grun.
A. minutissima Kuetz.
Amphora ovalis (Kuetz.) Kuetz.
Brachysira exilis (Kuetz.) Round & Mann
Cocconeis placentula Ehrenb.
Cymatopleura librile (Ehrenb.) Pant.
Cymbella microcephala Grun.
Epithemia turgida (Ehrenb.) Kuetz.
Fragilaria capucina Desm.
F. construens (Ehrenb.) Grun.
F. construens var. *binodis* (Ehrenb.) Grun.

F. leptostauron (Ehrenb.) Hust.
F. pinnata Ehrenb.
F. vaucheria (Kuetz.) J. B. Petersen
Gomphonema acuminatum Ehrenb. var. *coronatum* (Ehrenb.) W. Sm.
G. angustum Ag.
G. parvulum (Kuetz.) Kuetz.
G. pseudoauger Lange-Bert.
G. truncatum Ehrenb.
Gyrosigma attenuatum (Kuetz.) Rabenh.
Mastogloia smithii var. *amphicephala* Grun.
Melosira varians Ag.
Meridion circulare (Grev.) Ag.
Navicula cryptocephala var. *exilis* (Kuetz.) Grun.
N. oblonga (Kuetz.) Kuetz.
N. radiosa Kuetz. var. *tenella* (Bréb. ex Kuetz.) Gran. ex van Heurck
N. viridula (Kuetz.) Ehrenb.
Nitzschia linearis W. Sm.
N. palea (Kuetz.) W. Sm.
Simonsenia delognei (Grun.) Lange-Bert.
Stauroneis smithii Grun.
Surirella ovalis Bréb.
Synedra acus Kuetz.
S. pulchella Ralfs ex Kuetz.
S. ulna (Nitz.) Ehrenb.

TABLE 3. The cover of aquatic plants in Blue Pool measured on 23 July 1986 and the difference when resurveyed on 22 October 1986. Consideration is given only to plants with a cover of >2 m^2 on one of the survey days. After October 1986 *Rorippa* disappeared and all rooted aquatics became reduced to <10 m^2 whereas the area covered by filamentous diatoms is frequently >250 m^2 (almost 65% of bottom).

Dominant or co-dominant(s)	**Area of Stand or Clump**		
	July	**October**	**Difference**
Spermatophytes			
– single dominant:			
Potamogeton	54.75	37.75	−17.0
Callitriche	42.25	56.5	+14.25
Ranunculus	32.75	24.0	− 8.75
Elodea	27.75	28.0	+ 0.25
Rorippa	1.25	3.25	+ 2.0
– co-dominant(s):			
Pot./Call.	5.5	9.5	+ 4.0
Call./Ran.	0.0	2.75	+ 2.75
Call./Ran./Elod.	2.25	1.75	− 0.5
Call./Elod.	8.25	8.75	+ 0.5
Algae			
– main dominant:			
Spirogyra spp. (mainly on bed)	86.5	3.5	−83.0
Tribonema spp. (mainly epiphytic on *Potamogeton*)	61.0	47.25	−13.75

the steep sides where peat was exposed and from close to the springs where the bed was in constant motion. *Potamogeton* formed almost pure stands between 0.6 and 2 m on areas of deep sediment.

All angiosperms were rooted in the soft bottom deposits of silt and sand, whilst algae and the aquatic moss *Fontinalis antipyretica* grew on hard surfaces including flints, wooden stakes, tree roots, stones or concrete. Clumps of the gelatinous red alga *Batrachospermum* were found in the outflow channel and close to the eastern and southern bank. The two most common filamentous algae found in July 1986 were bright green growths of *Spirogyra* spp. and the yellow-green *Tribonema, T. viride* and *T. vulgare*. During this period all the *Potamogeton* plants supported heavy epiphytic growths of *Tribonema* so that total cover of this alga was considerable (see Table 3). Other filamentous algae, *e.g. Draparnaldia, Spirogyra, Ulothrix* and *Vaucheria*, and diatoms were also associated with the *Potamogeton*. Long and brownish skeins, attached in the shallows and growing on or entangled with the rooted aquatics, consisted almost wholly of colonial diatoms.

Noticeable changes took place over the three months from July to October 1986 and are summarised in Table 3. Some plants increased in cover whilst others showed a decline, in particular there was a significant loss of filamentous green algae from the shallows. Some angiosperms showed a small increase in cover, *e.g. Callitriche* and *Elodea*, whereas *Rorippa* and the moss *Fontinalis* more than doubled in area by the end of November. Of the macrophytes dominant in July only *Potamogeton* showed obvious signs of breakdown by October, with many of its floating leaves and stems then turned brownish in colour. Some algae, *e.g. Tribonema, Vaucheria* and *Batrachospermum*, showed increased cover in the autumn with many new clumps of the red alga *Batrachospermum* appearing in the shallows. *Lemna minor* was detected for the first time, caught up in vegetation fringing the western basin.

In the first week of December much of the vegetation was manually cleared from the pool leaving only small stands in the deeper western basin. The only *Rorippa* stand was reduced to a few plants. Of the rooted aquatics the least affected was *Elodea* which formed dense stands in the shallows along the southern shore and in the western basin. Few filamentous algae were detected at this time except for remnants of *Tribonema* growing in deeper parts of the eastern basin.

Seasonal and Temporal Distribution: 1987-1989

The aquatic vegetation showed some noticeable recovery by February 1987 with new growth of *Elodea, Ranunculus* and *Potamogeton*. A month later the floor of the pool was covered by brownish growths of filamentous diatoms with the exception of the gravelly bottom close to the outflow and the shallow ledge running along the north side of the western basin. Skeins formed by the diatoms not only covered most stable areas of bottom, but grew on the rooted vegetation and were entangled with it. *Rorippa* was no longer present and failed to become re-established over the investigation period. The 80-90% cover of diatoms, first evident in March 1987, persisted except for brief periods when it was manually removed from the shallows. A sample collected in March 1990 was found to consist almost wholly of *Melosira varians* (>90% of cells present in sample) with only a few other genera present, *e.g. Achnanthes, Gomphonema*. The blanketing growth of diatoms seems to have had a detrimental effect on the rooted aquatics. For example, only a few floating leaves of *Potamogeton natans* have been observed growing as far as the surface since the diatoms became dominant. All the aquatics recorded in 1986 still survive with new growth of *Callitriche* and *Ranunculus* most apparent during the winter months and early in the year. These plants were usually smothered with growths of diatoms except when growing close to spring areas where water movement is violent. It has been impossible to map accurately the extent of the rooted aquatics since the dramatic development of diatoms.

The bryophytes and the macroalgae, most common around the margin and in the outflow channel, appeared little affected by the diatom growths. The red alga *Batrachospermum* was present on most sampling visits and showed no detectable seasonality. In contrast, clumps of the yellow-green alga *Vaucheria* were most evident from November through to April. *Fontinalis* increased in area over this same period, becoming noticeable in the autumn (see Table 3). The smothering blanket of diatoms was present throughout the year with no detectable seasonality in its cover.

Discussion

Blue Pool is a typical artesian spring-fed pool: its water is physically and chemically very stable, comparatively cool (*c.* 10-12°C), moderately oxygenated, and fairly mineral rich (see Table 1). It supported before 1987 a macroflora dominated by four angiosperms and filamentous, principally green, algae. Other evident growths in the pool include *Fontinalis*, *Vaucheria*, and *Batrachospermum*. Filamentous diatoms became dominant in February 1987 and these brownish, often flocculent growths, continued to blanket much of its floor as well as the rooted aquatics for the remainder of the study (March 1990). A diverse assemblage of benthic algae exists within the pool besides the diatoms. These include many macroscopic green algae, *e.g. Draparnaldia mutabilis* and *Chaetophora elegans*, that are commonly reported from springs and winterbourn streams on chalk or limestone, *e.g.* source of the River Thames (John and Moore 1985). Rapid through-flow not only prevents stratification of the water column but also the development of a truly planktonic algal flora. Any algae sampled in the water column were benthic forms believed to have become swept into suspension by the turbulence created by the plankton net or by the violent discharge from the springs. Free-floating spermatophytes, *e.g. Lemna* spp., are probably carried into the pool by birds and are soon flushed out unless caught up in floating-leaved plants or flocculent growths of algae. Some of the aquatic macrophytes recorded in the pool, *e.g. Potamogeton natans, Elodea canadensis*, are reported to be characteristic of limnocrene springs, *i.e.* springs discharging directly into a small basin or pond. Benthic diatoms considered important constituents of small streams are also common, *e.g. Achnanthes, Fragilaria, Melosira*, and are usually reported growing in springs discharging directly into stream channels (Whitford 1956, Round 1960).

The seasonal pattern of development of the dominant aquatic plants is reflected by changes in cover. Despite the relative stability of the physical and chemical environment significant changes in cover took place been June and October 1986. Over this period the pool became turbid on several occasions, but no significant change in the aquatics was observed following each of these episodes. The fine particulate matter causing the turbidity is carried into the pool from the aquifer that feeds it. Turbidity is associated with pollution as the coliform bacterium *Escherichia coli* appears each time its water becomes turbid. The incompleteness of the data set makes it impossible to comment on any changes in water chemistry found during these pollution episodes. During the summer months these episodes are short lived, but at wetter times of the year they are more frequent and of longer duration. It takes less than an hour for the pool to loose its turbidity once the springs run clear due to rapid through-flow of water. The observed changes that took place in cover abundance between July and October 1986 of some of the aquatic plants are unlikely to be related to pollution since each episode rarely lasted more than a few days over this period. The changes are more likely related to normal seasonal phenomena such as a reduction in ambient light conditions as summer gives way to autumn. The cover of *Spirogyra* was reduced due both to seasonal die-back, possibly related to light conditions, and removal as part of pool management. A similar reduction in the cover of the filamentous *Tribonema* appears to relate, at least in part, to the die-back of *Potamogeton* on which it normally grows.

The present account is the first to deal with the composition, seasonality, and distribution of the flora of Blue Pool. In the absence of an earlier baseline survey it is difficult to assess whether the seasonal changes in the vegetation observed in 1986 were typical. The owners are convinced that the pool was no different in appearance in 1986 as compared to the previous years (Mr and Mrs Emm, pers. comm.). This is supported by dated photographs in their possession, first published in local newspapers (*e.g. Reading Mercury* 1965) showing a floating-leaved aquatic, probably *Potamogeton natans*. Interestingly, they have no recollection of such an aquatic prior to the 1950s and believe luxuriant growths of filamentous green algae date from the early 1970s. According to entries in detailed diaries kept by Mr Emm, turbidity first became evident in 1973 and 1974 and coincided with the removal of tall elm trees that shaded its surface. The prodigious growth of diatoms in the spring of 1987 and their continued dominance in the pool is a phenomenon not previously observed by the owners.

Diatoms showed no detectable periodicity in terms of cover-abundance unlike that recorded in many British streams and rivers; impressive growths of benthic diatoms often develop for a short period at least once (usually March-May) during the year (Casey *et al.* 1981). Throughout the year this group of algae blanketed most surfaces within the pool except where the bottom sediments were in constant motion (spring areas) or where the flow was sufficient to prevent the development of macroscopic growths. There is considerable loss of diatoms as evidenced by the frequent blockage of the grid in the outflow channel by flocculent growths or mats of these algae. According to Blum (1956) diatoms are sloughed off surfaces under constant flow conditions once a critical density is reached. The excessive growth of diatoms not only spoils the aesthetic appearance of this once attractive pool, but also adversely affects the growth of rooted aquatics, especially *Potamogeton*. Blanketing growths are known to weaken and then lead to the eventual loss of submerged, rooted aquatics. For example, growths of filamentous algae, encouraged by eutrophication, are believed to be responsible for many of the changes to the aquatic vegetation recorded in the Norfolk Broads (Phillips *et al.* 1978).

There is no obvious and intuitive explanation to account for the present dominance of diatoms since the nutrient status of its water has not significantly changed since 1986. A link with pollution cannot be established since these episodes began almost 20 years ago and have not increased significantly in recent years. The species of diatoms recorded in the pool have not changed, although prior to 1987 they were a subordinate element in its flora. It is interesting to note that the blanket development of diatoms was first noticed some three months after the manual removal of the rooted aquatics which left only rhizomes and other subterranean parts. The subsequent dominance of diatoms may be linked to this event, especially to the removal of *Potamogeton natans*. Its floating leaves might have exerted some control by reducing light penetration in the summer months, but cannot account for the year-round blanket cover of diatoms. Unfortunately, there exists no information on the fauna so it is impossible to determine whether the switch in dominance from rooted aquatics to filamentous diatoms might be caused by a reduction in grazing pressure. It remains to be seen whether the diatoms will remain dominant or whether in time rooted aquatics will gradually assume their former role.

The Thames Water Authority has been investigating the source of the intermittent pollution of the pool. In 1988 it carried out dye tests which confirmed one source of ground-water contamination to be from land drainage entering swallow-holes higher up the valley (Morgan-Jones, pers. comm.). Two swallow-holes, about 2 km to the west of the pool, were considered to be chiefly responsible and land drainage water was diverted away from one of these in the summer of 1988 and from the other in April of the following year. The turbidity episodes are continuing despite this action and the pool is still intermittently contaminated by coliform bacteria. If, as seems likely, contamination of the ground-water supplying the springs is from several sources, then the resolution of the pollution problem besetting the pool seems as far away as ever.

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An Examination of Tree-rings in Relation to Environmental Change in the Ruislip Woods

By V. WINCHESTER* and D. L. HAWKSWORTH**

Summary

Cores from 21 trees were taken from hornbeams and oaks in the Ruislip Woods, north-west London. While local factors, especially release in the oaks after hornbeam coppicing, accounted for much of the variation, a generally declining trend in growth-ring size was found to have been occurring since the 1930s. It is suggested that the decline in the last three decades particularly could well be attributable to photochemical air pollutants. This is a matter of concern if the management of the woods is to be continued in its traditional style in the long-term. Parallel investigations elsewhere in the Greater London area are advocated in order to determine if this is a widespread phenomenon in the region.

Introduction

The Ruislip Woods, in north-west London, collectively constitute the greatest wooded area in Greater London, occupying some 337 hectares (Figure 1). The woods are predominantly of oak *Quercus petraea* and *Q. robur* standards with coppiced hornbeam *Carpinus betulus*. Much of the area has been managed as coppice for many centuries, and some parts from at least the 11th century. Copse Wood and Park Wood were owned by King's College Cambridge from 1451 until 1931-6. The last major standard extraction was in the period 1873-98, and no general coppicing was carried out after the major part of the wood came into public ownership in 1931-6 until a new long-term management plan

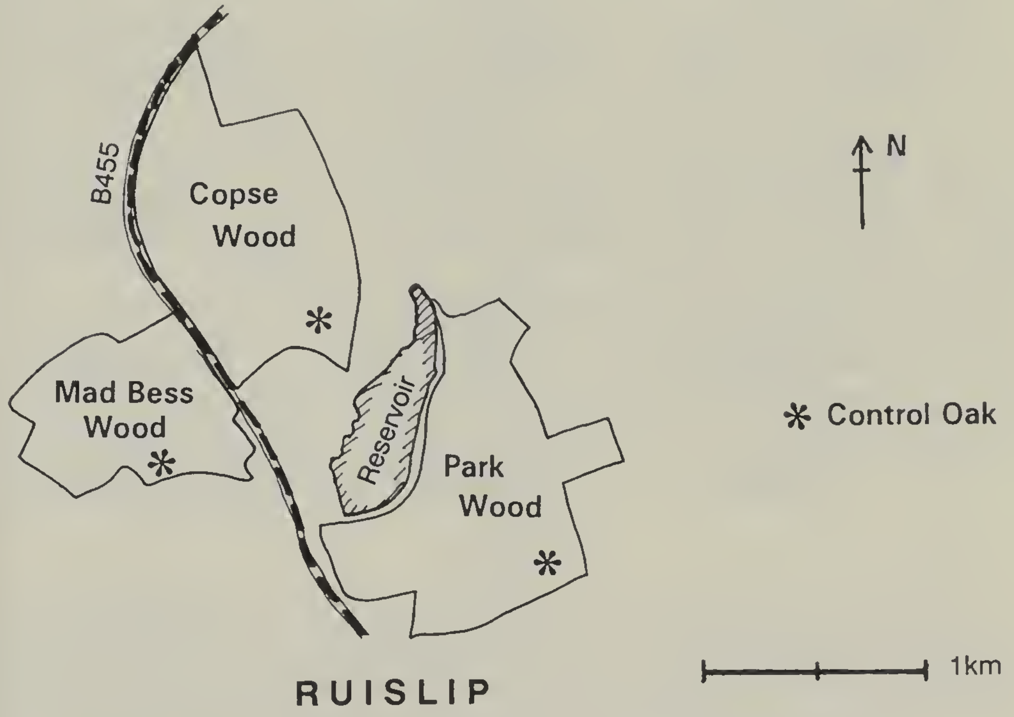

FIG. 1. The Ruislip Woods, showing the sites from which cores were taken (*).

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started to be implemented in 1981 (Ruislip-Northwood Woods Advisory Working Party 1982). Further information on the history and vegetation of the Ruislip Woods is provided by Bowlt (1989), Bowlt and Bowlt (1982), Crooks (1970), Ruislip-Northwood Woods Advisory Working Party (1982) and Wrighton (1979).

In the report of the survey conducted by the Ruislip-Northwood Woods Advisory Working Party (1982), attention was drawn to the fact that some small plots coppiced in the 1950s had shown poor regrowth, and that regeneration had been poor into the late 1960s. However, both regrowth and regeneration were found to be at an acceptable level in 1978-81. The Working Party noted that two hypotheses could explain this observation: either air pollution or climatic fluctuations.

A dendroecological survey was carried out in the Ruislip Woods to look for any evidence of environmental changes in the ring growth of coppiced hornbeams, and standard oaks, and also to assess the effect of changes in coppicing. Tree-rings have been widely used as indicators of environmental change. Annual growth is marked by early light and late dark wood seasonal rings; the amount of growth produced during any one season is reflected by the width of the ring. The problem is to identify which environmental factors cause width variations. Multiple factors can aid or limit growth and it may be difficult to determine precisely which of these predominate. A commentary on the technique, including a full discussion of its problems, has been provided by Fritts and Swetnam (1988).

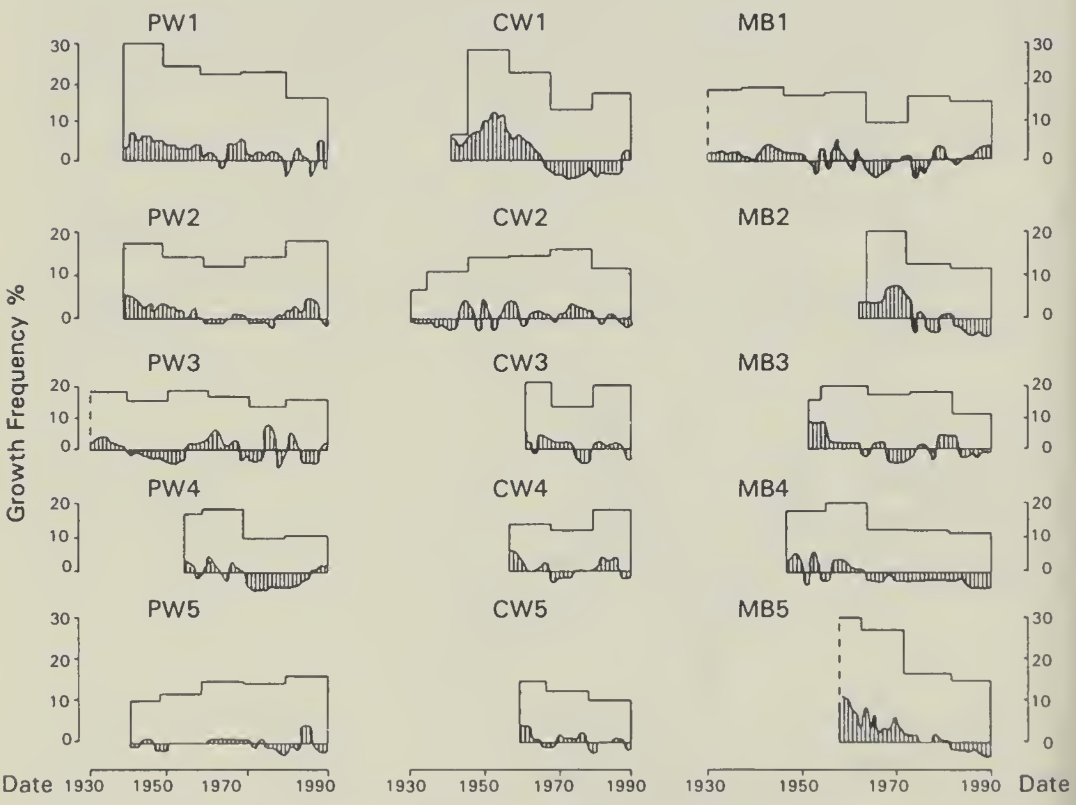

FIG. 2. Hornbeam growth 1930-90. Histograms showing 10-year sequences of ring growth, with percentage growth frequencies based on an average core length of 121.3 mm. Line graphs below each histogram represent estimates of seasonal growth, as shown on the core by wide or narrow rings, using the histogram base lines to represent average ring width for the sample.

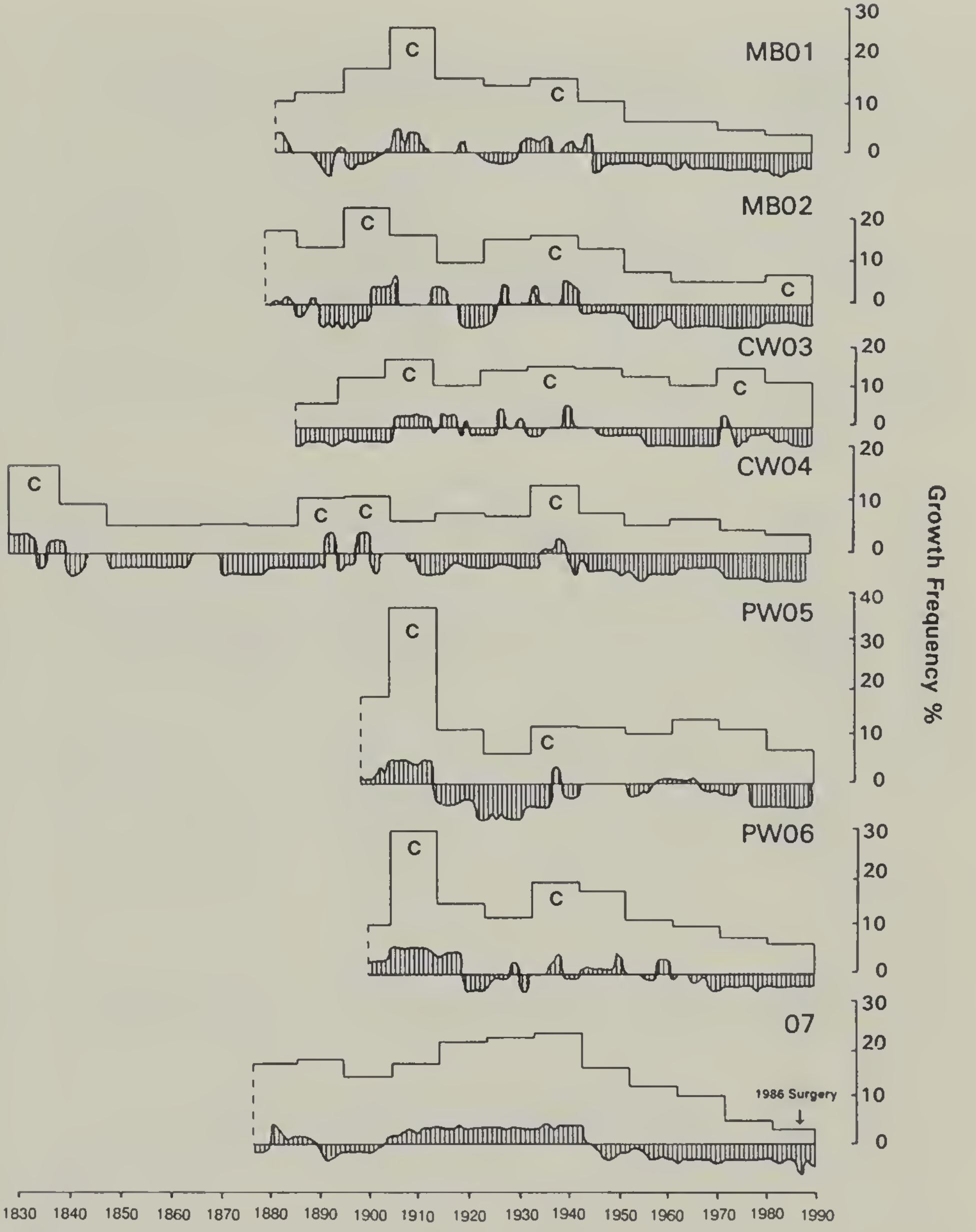

FIG. 3. Oak growth to 1990. Presentation as for Fig. 2. C = possible release after the coppicing of adjacent hornbeams.

Methods

On 20 November 1990 twenty-one 5.15 mm diam cores were collected from three separate sections in the Ruislip Woods using an increment borer inserted into the trees at a height of approximately 1.25 m. The sample sites included Section J of Mad Bess Wood, Section L of Copse Wood, and Section E of Park Wood (Section notation follows Crooks 1970). Five hornbeam and two oak cores were sampled in each Section. The position and growing conditions of each trunk and pole were recorded (Table 1) to provide background information on the growth history of the samples and to assist in the analysis of factors affecting ring width. The soil in all three Sections studied is leaf-mould and loam over London Clay.

Table 1. Sample data and observed growth conditions.

Core number	Ring count	Tree dominance	Circum-ference cm	Trunk diameter cm	Trunk centre cm	Core length cm	Canopy spread m^2	Tree height m	Damage	Nearest 3 neighbours m
HORNBEAM										
MB1	70	Codominant	77.5	24.6	off 1.5	13.7	4.0	7	Rodent	1/2/5
MB2	32	,,	74.5	23.7	off 5.0	9.7	3.0	7	Twisted	4/4/4
MB3	50	,,	69.5	22.1	off 0.3	8.3	6.0	7	Rodent	2/2/3
MB4	44	,,	67.0	21.3	Centred	7.8	4.0	7	Twisted	3/2/–
MB5	36	Dominant	9.0	29.0	off 5.0	14.5	8.0	8	Slight rodent	3/4/5
CW1	42	Dominant	87.0	27.7	off 2.0	13.7	12.0	8	Bowed	4/8/6
CW2	54	Codominant	80.0	25.5	Centred	9.7	8.0	7	None	2/3/4
CW3	28	Stress	38.5	12.3	,,	5.2	3.5	5	Bowed	2/3/5
CW4	30	,,	31.0	9.8	,,	4.8	3.0	5	None	1/2/2
CW5	27	,,	37.0	11.8	,,	4.8	3.5	5	,,	2/2/5
PW1	50	Codominant	92.5	29.4	off 0.75	13.4	4.5	8	Slight rodent	3/38
PW2	50	,,	83.0	26.4	Centred	10.0	4.0	8	Heavy rodent	3/3/4
PW3	59	,,	56.5	17.9	Short of centre	9.5	3.0	8	Broken	3/3/4
PW4	38	Stress	44.5	14.2	Centred	5.8	3.0	6	Very twisted	3/3/5
PW5	48	Codominant	60.0	19.1	Centred	8.5	4.0	8	Slight rodent	4/5/7
OAK										
MB01	115	Dominant	133.0	42.5	off 2.0	18.8	4.5	8	–	2/3/4
MB02	116	,,	153.0	48.7	off 2.0	18.5	5.0	8	–	,,
CW03	111	Codominant	125.5	39.9	off 4.0	17.6	5.5	7	–	2/3/3
CW04	170	Dominant	134.0	42.6	Centred	19.0	5.0	8	–	–
PW05	96	,,	147.0	46.8	Short of centre	18.0	10.0	8	–	4/6/7
PW06	95	Codominant	123.5	39.3	,,	17.2	5.0	7	–	7/7/8
–07	120 +	Isolated	313.0	99.6	Half radius	23.0	11.0	13	Tree-surgery 1986	–

MB = Mad Bess Wood; CW = Copse Wood; PW = Park Wood; –07 = Control.

Histograms (Figures 2-3) were produced to show differences in growth between 10-year ring sequences starting from the cambial layer under the bark. The varying lengths of each sequence were measured and converted to a percentage of the mean length of the samples. This approach was designed to: (1) provide a measure of comparison between the samples, (2) smooth out some of the 'background noise' introduced by the many possible variables affecting growth over the short-term, and (3) reveal underlying growth trends.

A difficulty with this approach is that trends could be masked by the arbitrary choice of 10 years for the sequence length; any one 10-year period could include both maximum and minimum growth episodes not conforming to the trend. This difficulty was allowed for by including graphs of annual growth using the histogram base lines to represent the average ring width of each core. Estimates of maximum and minimum growth episodes can thus be traced to individual years and the information checked against that provided by the histograms.

Results

Mad Bess Wood (MB) Section J (Ordnance Survey grid reference TQ(51) 078892).

All five hornbeam cores showed slightly declining growth between 1970-90. Between 1960-70, growth varied: MB2 and MB5 showed high growth, MB4 sustained the same growth levels as over the 1970 period, while MB1, and to a lesser extent MB3, showed greatly decreased growth. Except for MB1 and MB3, annual ring peaks decline from the 1960s onwards. The growth rings in both oak cores (MBO1 and MBO2) become increasingly compressed from the 1930s to the present, suggesting either declining growth with age and increasing trunk diameter, or poor growing conditions.

Copse Wood (CW) Section L (Ordnance Survey grid reference TQ(51) 086898).

Three of the hornbeam cores, CW1, CW3 and CW4, showed increased growth in the 1980s and lower growth in the 1970s. This situation is reversed for CW2 and CW5, with growth declining in the 1980s. The tree from which the CW1 core was taken was standing next to a large clearing; the growth shown in this core was very low in the late 1940s followed by high growth in the 1950s; possibly the area was cleared at this time. The generally low growth shown by CW3, CW4, and CW5 illustrates the poor coppicing practiced in this part of Section L in the 1950s when all growth was cut back. The regeneration which followed was thin and straggly with the production of multiple poles. Two of the three cores from this area suggest that growth increased over the last 10 years, but the rings show that growth again declined in the last two to three years of the decade. Growth rings from the oaks (CWO3 and CWO4) standing just outside the area of poor coppicing follow a closely similar pattern of decline to that of the two oaks studied in Mad Bess Wood (with the exception of a period of higher growth in CWO3 during the 1970s). All four oak cores show annual peaks in the mid-1930s.

Park Wood (PW) Section E (Ordnance Survey grid reference TQ(51) 096886).

For four of the hornbeams, PW2, PW3, PW4 and PW5, there is an increase in growth evident between 1970-90. However, for PW1 there is a long-term decrease between 1940-80. The generally high growth and the lack of coppiced stumps around this pole suggests that this is an example of a sapling growing without competition from neighbouring poles. The later low growth in the 1980s could be due either to decreased growth with age, or stress from an external source. PW2's ring growth is least in the 1960s with the decline starting in 1940. By contrast, growth in PW3, PW4 and PW5, was relatively higher in the 1960s, although generally growth in these three cores is rather low, due possibly to shading from nearby oaks. The annual growth rings show a small peak around

1966-8 and a trough in 1980. The two oaks (PWO5 and PWO6) again show declining growth from the 1930s with a high in the middle of that decade.

Control.

A control oak core (-O7) was taken from an apparently 270-year-old tree (Tree Preservation Order No. 85A 1971, tree No. T98) in the garden of 9 Arden Mhòr, Eastcote, Pinner (Ordnance Survey grid reference TQ(51) 108894), 1 km east of Park Wood. The tree underwent surgery in 1986 and growth since that time has been especially low.

Conclusions

It is clear from the results obtained that variation in growth between the individual hornbeam samples is at least as great as variations between sample groups in the different Sections. Thus, no single environmental factor can be affecting growth. The sample records suggest possible reasons for growth variations in the Ruislip hornbeams (Table 1). A comparison of the records suggests that poles that are heavily shaded or in competition with others on the same stool, show generally depressed ring growth. In contrast, on the edge of clearings, where there is more light and moisture, growth increases.

The Ruislip-Northwood Woods Advisory Working Party (1982: 26) considered that there appeared to have been an increase in hornbeam regrowth and regeneration in the last decade. However, the analytical approach adopted in the present study suggests that the previous assessment could be over optimistic, at least as regards annual growth increments. Growth appears to have been generally in decline for eight of the 15 samples taken, while a further two show a growth reduction over the last decade relative to the preceding 20 years. It would seem, therefore, that either the sample number was too small to represent growth in the Woods, or that growth is becoming increasingly stressed.

One possible factor limiting hornbeam growth could be an increase in rodent damage; many of the stools and lower poles showed bark loss attributable to grey squirrels *Sciurus carolinensis*. However, rodent damage is unlikely to be the main reason for growth reduction since all the six oaks also show a general reduction, as did the apparently 270-year-old control sample (core -O7) in a garden. It therefore seems likely that the decline, in the oaks at least, is not a local effect but due either to air pollution or to climatic or general environmental changes since the 1930s. A possible narrowing of the rings produced by increasing age can be discounted since the control sample, which is probably almost twice the age of any of the woodland oaks (where the maximum ring count is 170 for a centred core, Table 1), shows much the same decline over the same period.

With regard to the ring growth of the oaks, a peak in the ring sizes of the six woodland oak cores is likely to be associated with growth release following clearance of the hornbeams in the 1930s prior to their transfer into public hands, probably in 1935-36. This timing agrees with ring-counts made on coppiced hornbeam surfaces in Mad Bess Wood and Park Wood (Ruislip-Northwood Woods Advisory Working Party 1982: 26). The cores show other possible episodes of high growth which may also relate to coppicing at intervals of between 30-40 years (marked 'C' in Figure 3). Between 1900-1922, a 12-year rotation was recommended for coppicing (*loc. cit.*: 14), and the longer interval suggested by the histograms may be because the rotation schedule was only notional and coppicing depended on prevailing woodland conditions.

The initial coppicing of this century appears to have been carried out between 1900-1905; four of the six oak cores show high growth over that period; while two others, MBO2 and CWO4, show high growth between 1890-1900. There is documentary evidence for extensive coppicing in this period (Bowlt and Bowlt

1982). The likelihood of the oak growth peaks being related to hornbeam coppicing (*cf.* Bridge *et al.* 1986) is reinforced by the absence of similar peaks in the control garden oak; though that oak does show minimal growth following severe tree surgery in 1986.

The main influences affecting the ring growth of the hornbeam poles seem more likely to be related to individual growing conditions and coppicing practices than to general changes due to air pollution or climate. The oak standards may be more reliable indicators of general environmental change, but tracing the effects of a particular variable on ring growth is notoriously difficult; growth performance may be controlled by a number of interactive variables including extreme weather events, changes in temperature and precipitation, competition, episodes of insect or other animal attack, disease, and fire. Man-made growth inhibitors include various air pollutants, pesticides, herbicides, changes in land-use practices and other human activities.

Drought, in particular, could have been a factor effecting the last six decades of growth in the Ruislip Woods. Rainfall records from 1930-89 for Ruislip were examined and the annual totals were aggregated in 10-year increments to be comparable with the decadal approach adopted for tree-ring analysis (Figure 4). Rainfall increased from 1930-49, peaked between 1950-69, then declined from 1970-89. None of the oaks shows growth which could reflect this pattern; thus we can exclude drought as a causative factor in general growth limitation over this period. By their nature, episodic factors detrimental to growth are unlikely to have been active over the longer-term in all three woods, but man-made inhibitors could be reponsible for growth reduction. Huettl (1989: 35) states that 'It is well known that trees affected by phytotoxic air pollution concentrations react to this stress ... [by showing] decreasing radial and volume growth long before symptoms become apparent. It has also been found that these reactions are reflected adequately only in dominant or predominant trees with adequate crown development'. The Ruislip oak standards would thus seem prime candidates for this type of growth limitation.

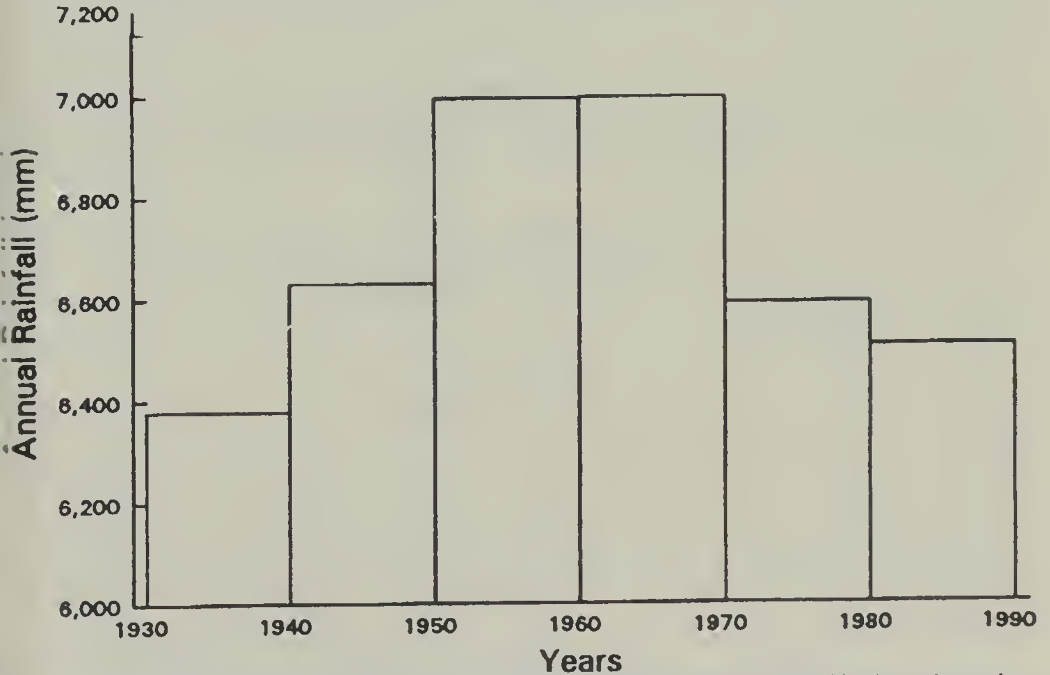

FIG. 4. Decadal totals of annual rainfall in the Ruislip Woods 1930-89. Based on data gathered from gauges at TQ(51) 0908777 (0.25 m south of Park Wood; for 1946-89), TQ(51) 086891 (Ruislip Reservoir for 1936-45), and TQ(51) 080880 (Ickenham Sewage Works).

Sulphur dioxide damage to the oaks over the last two decades must be discounted as lichen species sensitive to sulphur dioxide have progressively been reinvading the area since the mid-1970s (Rose and Hawksworth 1981, Hawksworth and McManus 1989). However, sulphur dioxide could have been important through the 1950s and 1960s. That tree growth may now be increasingly limited by other air pollutants cannot be discounted, especially that due to photochemical reactions (smog resulting from the action of strong ultraviolet light on a mixture of nitrogen oxide, hydrocarbons and ozone) produced by a combination of increases in motor traffic and warm summers (Smith 1975). This has become an increasing cause for concern in the London area and Ruislip may well be affected; ozone is the only gaseous air pollutant that shows a clear trend of increasing concentrations with increasing distance from emission sources (Oblaender and Hanss 1985). Lichens are unlikely to be damaged by such effects since they are inactive during hot, dry days when photochemical reactions are strongest. Studies in North America have shown lichen patterns to correlate with sulphur dioxide and not photochemical pollutant patterns (McCune 1988).

Huettl (1989: 39) states: 'Of all investigated gaseous air pollutants in areas of new type forest damage, only O_3 reveals a positive correlation with the spatial and temporal development of damages. In addition, O_3 has the highest degree of phytotoxicity based on concentration and duration of exposure. It is therefore reasonable to assume that photooxidants may play a role, at least regionally, in causing this phenomenon'.

Despite the difficulty in identification of particular stress factors affecting growth, the general growth decline noted as beginning in the oaks in the 1930s is a matter for some concern. Indeed, if the Woods are to be preserved as a public amenity and traditionally managed, a continuing watch needs to be kept on their long-term health, with research carried out at regular intervals to monitor any future change; the importance of this was stressed by Moxey (1976). While it would be premature to place too much emphasis on a study with limited controls, nevertheless it would be of interest to know whether the decline in oak growth found in the Ruislip area is a widespread phenomenon in the Greater London area.

On a general level, this study suggests that a combination of dendroecological information and lichen studies could be useful in separating the effects of long-term photochemical reactions from those of sulphur dioxide as causes of tree decline.

Acknowledgements

We are grateful to Mr C. Chambers, Arboricultural Officer, London Borough of Hillingdon, for permission to conduct this investigation and to Miss G. Godwin for assistance with the artwork.

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Book Reviews

The Encyclopedia of the Earth. Oceans and Islands. Consultant editors Dr Frank Talbot and Dr Robert E. Stevenson. ISBN 1-85391-156-9.

Encyclopedia of Animals. Birds. Consultant editor Joseph Forshaw. ISBN 1-85391-186-0.

Fantastic Journeys. The Marvels of Animal Migration. Consultant editor Dr R. Robin Baker. ISBN 1-85391-185-2. Each Merehurst Ltd, London. 1991. 240 pp. £25.

These three books, with page sizes of 12″ × 9½″, are superbly produced and lavishly illustrated throughout with colour photographs and drawings. In each case, teams of international experts have contributed to the whole and the results are extremely pleasing.

Oceans and Islands explores the ocean wildernesses, the coastal seas and the oceanic islands around the world. It takes the reader into the diverse and intriguing workings of our marine and island environments and alerts us to the threats posed by man's exploitation of what amounts to 70% of the Earth's surface. The book is divided into three main sections, 'The Miracle of the Sea', 'Islands: Worlds Apart' (the diversity of the island environment) and 'The Future of Oceans and Islands'. We are used to rather standard physical illsutrations of the Earth in the preambles of many atlases, but here we are given the full treatment with a good balance of geophysics, geology, and biology which should appeal to naturalists. The animals illustrated range from marine mammals, birds and invertebrates to reptiles and mammals on oceanic islands.

Birds covers all the living orders of the Aves and within each group species are selected from a range of habitats. Feeding, mating and nesting are well illustrated and we are treated to many remarkably sharp photographs. An underlying theme throughout the book is the great threat to habitats posed by human activities. More than 1,000 species of birds are threatened with extinction today. 'A better understanding and appreciation of the world of birds, and the preservation of their habitats, are essential to the survival of the many endangered breeds *[sic]* in the bird kingdom.'

Fantastic Journeys brings together with superb colour and clarity the vast subject of the book's subtitle 'The Marvels of Animal Migration'. After being introduced to 'The Mysteries of Migration' the next part is 'Aerial Epics' ranging from insects and arachnids to birds and bats; then follows 'Ocean Odysseys' with lobsters, fishes, turtles and marine mammals, and lastly 'Cross-country Marathons' with reptiles and amphibians, small mammals, carnivores, elephants, ungulates and man – including reference to the latest urge to explore the solar system!

In these very brief reviews I have not referred to individual items. I recommend that you read all three books yourselves and enjoy them as much as I have.

K. H. Hyatt

Book Reviews

The Illustrated Field Guide to Ferns and Allied Plants of the British Isles. By Clive Jermy and Josephine Camus. Illustrated by Peter Edwards. Natural History Museum Publications, London. 1991. Paperback. 194pp. £7.95. ISBN 0 565 0 1172 3.

In 1987 the above authors produced a 32-page booklet called the *B.M. Fern Crib*, to aid botanists participating in the B.S.B.I. Distribution Monitoring Scheme. It was then realised that a diagnostic guide to all pteridophytes would be welcomed by those who found the group difficult, and the present book was produced with both these people and beginners in mind.

Clubmosses, quillworts, horsetails and ferns are covered by the book. Brief introductory pages are followed by a general key, after which the bulk of the book consists of systematically arranged descriptions and illustrations of every native and some alien species, plus subspecies and morphotypes (the latter being subspecies whose exact status is still subject to debate). Each is tabulated and is given a two-page spread (one page in the case of the aliens). Somewhat surprisingly, common names are given precedence over Latin names on these pages, and the authors appear to have struggled to come up with titles for new morphotypes, such as the tortuous 'Greater Western Scaly Male Fern'. Superseded Latin names, which one will come across in earlier books, are included in the index.

Diagnostic features are printed in heavier type. Short notes are added giving details of habitat, distribution and conservation status (the last indicating whether or not the species is under threat in any way), followed by a useful 'Compare with' section pointing out the differences of similar species. Distribution details are a little sketchy: one is told very little about the frequency of some species throughout their range, for example.

Hybrids are mentioned where appropriate, and there are charts showing which species is known to cross with which, although the authors refer those who wish to delve further to more comprehensive books.

The keys I found very well laid out and simple to use; when tested they led me to the correct species every time. However, a few terms in both the keys and the plant descriptions had me thumbing for the glossary, which I feel is too brief. Some terms are only to be found on an illustration opposite the glossary, but these have to be searched for as by necessity they are not in alphabetical order, while other terms can only be found by re-reading the introduction.

Although Peter Edwards is credited on the covers and title page with being the illustrator, he was only responsible for the superbly clear line drawings of, for example, leaf segments and sori. The larger illustrations of stems and fronds are silhouettes mostly prepared by the Museum's Photographic Unit. While these give a general impression of the appearance, they are sometimes rather heavy and 'blotchy', they lack any depth, and furthermore no scale is given. Typical stem or leaf lengths are given in the text alongside but, as an example, 36 *Thelypteris palustris* ('sterile leaves up to *c.* 80 cm, fertile leaves up to *c.* 150 cm') is shown the same size as 37 *Phegopteris connectilis* ('leaves 20-40 cm long').

A printer's error on p.183 has transposed the illustrations of the two cultivated species of *Blechnum, penna-marina* and *cordatum*.

Regardless of what I feel are its weak points, I am gladdened by the appearance on the market of such a comprehensive and up-to-date book on the subject, of a size which will readily slip into a bag or a large pocket for carrying into the field, and at a relatively inexpensive price by today's standards. Although I wonder if being a Museum publication will restrict the book's general availability, I would urge its purchase by all who are interested in our wild flora so that they can find for themselves the diversity of this beautiful and fascinating group, and be able to identify it with some certainty.

Howard Matthews

A World of Ferns. By Josephine M. Camus, A. Clive Jermy and Barry A. Thomas. Natural History Museum Publications, London. 1991. 112 pp. Profusely illustrated in colour. £10.95. ISBN 0 565 00120 0.

For this volume, two authors from the Natural History Museum are joined by Barry Thomas, current President of the British Pteridological Society, in a celebration of that Society's centenary. With nearly 200 coloured photographs scattered through its pages, it appears at first sight to be an ornamental rather than a useful product, but closer examination reveals a dense text and illustrations which throw much light on details of the reproductive biology of pteridophytes which remain obscure in a verbal description. There are a few regrettable errors: in particular the horsetail shown on page 12 is certainly not *Equisetum arvense*.

Rodney Burton

Brookhouse Brook Revisited: Notes on the Recovery of Macro-invertebrates Following Livestock Slurry Pollution in a Clay Stream

By S. Boreham*

Abstract

The macro-invertebrate benthos of eight sites on an Essex clay stream were investigated in October 1989 and October 1990 to monitor its recovery following chronic livestock slurry pollution outlined in previous work (Boreham *et al.* 1989). Although a rapid recovery occurred, this has been limited by dry summers which have seriously affected previously species-rich sites in the headwater catchment.

Introduction

Brookhouse Brook is a major tributary of the River Roding in south-west Essex draining an 18.1 km^2 catchment of predominantly agricultural land underlain by London Clay on the eastern slopes of Epping Forest. Previous work assessing the effects of livestock slurry pollution from Great Gregories Farm on the macro-invertebrates of this stream pointed to an expected faunal recovery following the cessation of dairy operations in the summer of 1989 (Boreham *et al.* 1989). These notes present macro-invertebrate records from 1985-1990 which demonstrate the speed and extent of recolonization.

Methods

In October 1989 and October 1990 seven sites on Brookhouse Brook and one on a tributary were sampled for macro-invertebrates (Figure 1). Sites 6 and 7 were upstream of the farm outfall, Sites 5-3 were previously most affected by slurry, and Site 1 was about 2 km downstream of the farm. Methods were generally as outlined by Boreham *et al.* (1989), except that samples were sorted in the field. The Biological Monitoring Working Party (BMWP) score (National Water Council 1981) and the Average Score Per Taxon (ASPT) of Murphy (1978) were also applied to the data.

Results and Discussion

The results presented are a combination of work undertaken in 1989-90 and previously unpublished data from 1985-1988. Figure 1 shows selected macro-invertebrate distributions for Sites 1-7 over the study period displayed on bird-cage grids. Presence of taxa is indicated by shading and the five sampling dates are indicated with October 1985 at the top of each grid and October 1990 at the bottom. The 'rat-tailed maggot' *Eristalis tenax* was the only organism excluded from the stream by the reduction in livestock slurry pollution. The heavily silted riffles at Sites 5 and 4 where it previously occurred had reverted to clean gravel by October 1989. Abundance of the ubiquitous chronomid midge larvae and tubificid worms were also affected by the less eutrophic conditions. Several thousand individuals of each taxon were captured per 30-second kick sample in 1987, but by 1989 this was reduced to a maximum of 40. The crustaceans *Asellus aquaticus* and *Gammarus pulex* returned rapidly to sites 5-3 as pollution became less severe. However the molluscs *Potamopyrgus jenkinsi* and *Pisidium* sp. returned much more slowly, although they were present both upstream and downstream. Another mollusc *Lymnaea peregra* (the wandering snail) spread upstream to Site 4. It was not present at Sites 6 and 7 throughout the study period suggesting that its distribution was limited by other factors. Although pulmonate gastropods breathe air, *L. peregra* is intolerant of desiccation, but

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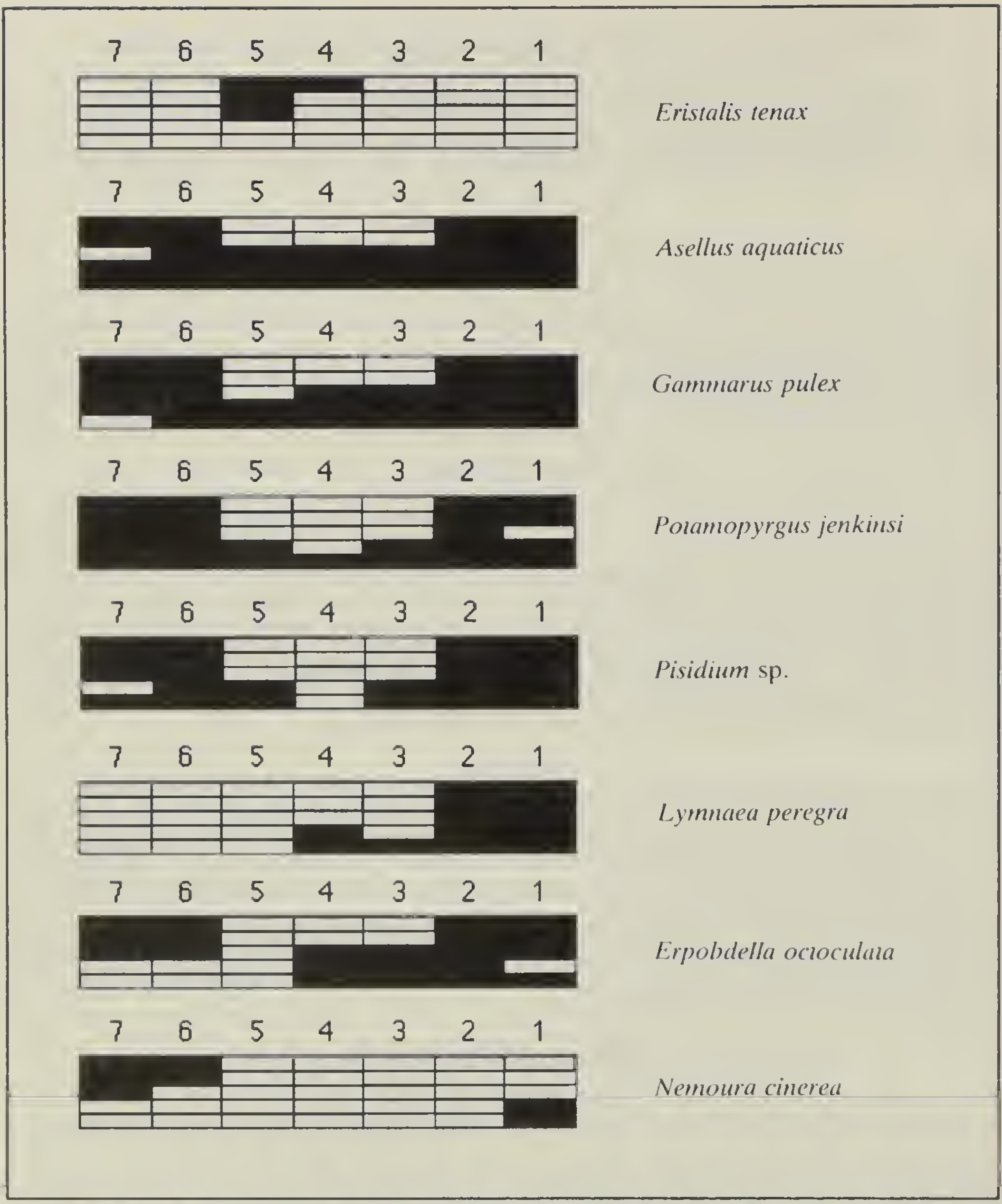

Fig. 1. Selected macro-invertebrate distributions for sample Sites 1-7 over the study period displayed on bird-cage grids. Presence is indicated by shading. Sampling dates run from top to bottom in each grid as follows; October 1985, February 1987, October 1988, October 1989, October 1990.

the prosobranch (gill breathing) *P. jenkinsi* appears to survive drought by sealing its operculum against adverse conditions. Farm run-off still enters the stream above Site 5, but the presence of *G. pulex* indicates that this effluent is of reasonable quality. The leech *Erpobdella octoculata* also colonized upstream to Site 4, and its absence from Sites 6 and 7 in 1989-90 indicates serious problems in the headwater catchment. This is confirmed by the loss of the stonefly *Nemoura cinerea* and Trichoptera (caddis-flies) from Sites 6 and 7 over the same period. Drought caused by the dry summers of 1989 and 1990 is almost certainly the cause of the observed reduction in species richness, and was so severe that grass and other herbs invaded the gravel riffles between Sites 6 and 7 in summer 1990. This has therefore seriously limited the extent of downstream colonization. However improved water quality had allowed the pollution-sensitive *N. cinerea* successfully to reproduce at Site 1 by October 1989.

Figure 2 shows the BMWP and ASPT scores for Sites 1-7 over the study period. Both indices show similar patterns, with improving water quality at Sites 1-5 and decreasing scores especially at Site 7. Site T on a tributary with its confluence above Site 2 remained relatively stable. The BMWP score can be affected by seasonal variation, and values for February 1987 are higher at some sites than for other sampling dates. However the ASPT shows that by October 1989 invertebrates below the farm outfall at Site 5 had a similar pollution tolerance to those at many other sites.

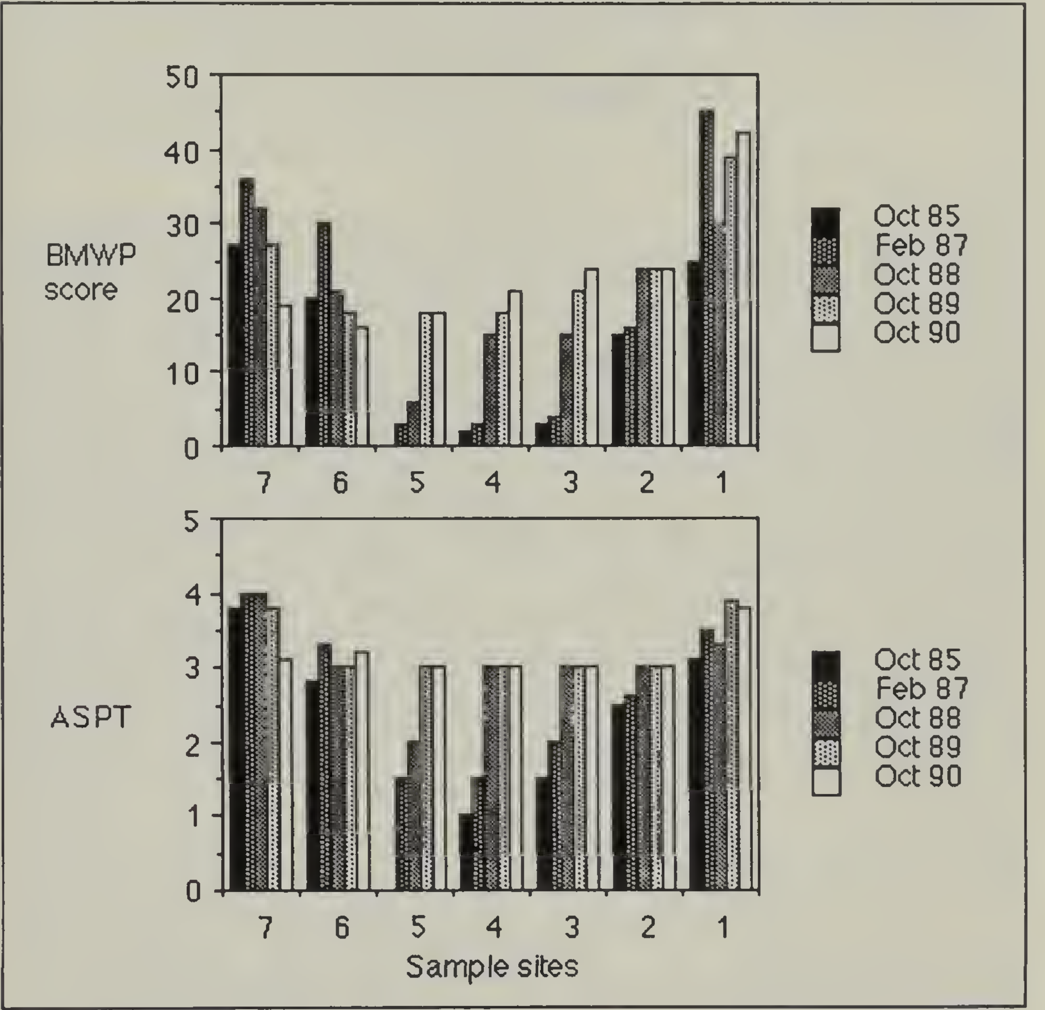

FIG. 2. BMWP and ASPT scores for Sites 1-7 over the study period.

Conclusions

The rapid recovery of the macro-invertebrate benthos of Brookhouse Brook following livestock slurry pollution has occurred despite drought conditions in the summers of 1989 and 1990. Although farm run-off continues to affect the stream, it appears that the main restriction on invertebrates has been lack of water. The loss of characteristic specialist taxa from the previously diverse headwater sites has seriously limited the opportunities for recolonization from upstream. The occurrence of *N. cinerea* at Site 1 demonstrates the improvement in water quality which has taken place with the cessation of dairy farming at

Great Gregories Farm. With wetter summers and sustained improvements in the quality of farm run-off, it is possible that a diverse macro-invertebrate fauna could return to much of upper Brookhouse Brook.

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Book Review

Safari. By Barbara Radcliffe Rogers. J. B. Fairfax, London. 1991. 128 pp. £14.95. ISBN 1 85391 207 7.

Initially this rather lavish, 11½″ square, book was to me a disappointment. This was mainly because the opening chapter on 'The History of Safaris' dealt so vividly with the deeds of our Victorian safari forbears. However, perhaps I am being unfair: none of us would condone the methods and results of these big game hunts, although we have all read, and surely enjoyed, their narratives. The mass slaughters of the past are very different from the controlled hunting or culling of today which can have immense conservation value and can benefit the species being culled as well as others in the same habitat, and even the habitat itself. Often it is the weaker ones that fall to the cull, which can improve the wellbeing of the population. There wouldn't be much vegetation left in Africa, for instance, if elephants and giraffes were allowed to multiply unchecked.

Although King George V 'spent a week in the Nepalese Terai where he enjoyed some excellent shooting...King George's suite accounting for no fewer than sixty-two specimens of big game, including some thirty-nine tigers' *(Nat. Hist. Mag.* **5**: 250 (1936)), not all British royalty went big game hunting. We are told in *Safari* that the Prince of Wales, later King Edward VIII, who was a good shot with both gun and camera, became a strong advocate of the photographic safari. If hunting hadn't been the in thing, the famous hunters as we know them would almost certainly have done something equally outstanding in the realm of conservation. And, indeed, many of the early hunters, and later, settlers, in Africa, became conservationists – even if only for their own benefits. But where would our knowledge of the world's fauna and flora be without the collections amassed by the intrepid explorers of the past, and upon which we, as naturalists, base our studies? Fortunately they travelled mainly on foot, and consequently what they collected was the result of sheer, hard work. Just imagine what they would have done if the roads of today and helicopters and modern weaponry had been around! Sadly a few species became extinct as a result of selfish, unscientific activities, but far more species are threatened by man's current destruction of their habitats. For me this chapter could have been omitted.

So let us turn to the brighter side of the book. There is much of great interest in *Safari*, which is about Africa only. The remainder of the first half is devoted to 'Modes of Safari' and 'Expedition Geography and Wildlife', whilst the coloured photographs of the scenery and birds and mammals which comprise the second half, 'The Face of Africa', are first class. The 11-point text, which is set mainly double-spaced, has resulted in there being very little actual reading matter, and the photograph of guests at a National Park, sitting on a wall and supposedly watching the wildlife in the distance, whilst between them stand large glasses of beer (or worse, lager), isn't this reviewer's way of enjoying nature!

A lot of people are involved in organizing wildlife tours all over the world and a fine job they do of it, especially for the benefit of the least physically active. Additionally they know the welfare of the 'prey' is of paramount importance, whilst the 'natives' are encouraged to participate, either as guides or wardens, which is a far cry from their earlier need to hunt to prove their virility within their tribes, or as poachers of ivory.

Having started off on a rather gloomy note I would like to finish by saying that this book has put the modern safari into perspective and will, I am sure, provide plenty of interest for any future Burchell, Livingstone or Selous amongst us.

K. H. Hyatt

Butterfly Monitoring at Fryent Country Park, Middlesex, 1986-90

By L. R. WILLIAMS,* A. KWISSA, D. BROWN and J. BROWN

Abstract

Butterflies were monitored at approximately weekly intervals between April and September on a 3.2km transect at Fryent Country Park, Middlesex from 1986-1990. Records provided indices of the relative abundances of the butterfly fauna. The Country Park is surrounded by suburbia, but is an enclave of Middlesex countryside with hay-meadows, rough grasslands, hedgerows, scrub and woodland habitats. The high proportion of hay-meadows appeared to provide ideal habitat for the meadow brown *Maniola jurtina* which was present at a high density. Opportunities for comparing the data with other monitored sites in London and southeast England are discussed.

Introduction

Butterfly transect monitoring in which a set route is walked once a week to monitor the butterflies present was first tested at Monks Wood Experimental Station in the 1960s and early 1970s (Pollard, Elias, Skelton and Thomas 1975). Providing that certain criteria were observed, mainly relating to the timing and the weather conditions in which the transect was walked, the method was found to be a reliable tool for monitoring butterflies and had considerable potential (Pollard 1977). The method could detect changes in the abundance of butterflies within the course of a season and between years. The effect of habitat loss on butterflies or the effectiveness of habitat management at nature reserves can be assessed by use of the method. Long-term monitoring may show how butterflies are affected by changing climatic conditions.

In 1976 a national scheme was launched and quickly expanded to about 80 sites throughout Britain, most of which were managed by the Nature Conservancy Council or other conservation organisations. While this ensured a wide geographical coverage and provided information on almost all the British butterfly species, the results were not representative of the British countryside. For example, only about eight of the transects were on farmland and only one, at Hampstead Heath, was in an urban area. However, the quantity of data obtained was remarkable and a summary of the first 10 years of the scheme, 1976-85, was published by the Nature Conservancy Council (Pollard, Hall and Bibby 1986).

Unfortunately the national scheme was unable to handle data from any further transects and several independent transects were established. One of these, at Fryent Country Park, was first walked in 1986 and a summary of the data for the first five years of recording is given in this paper.

Fryent Country Park is managed by the London Borough of Brent assisted by volunteer conservation groups. The Country Park is about 15km north-west of central London and is surrounded by surburbia. It is bisected by Fryent Way (the A4140). The Park covers about 100 hectares of traditional Middlesex countryside, largely on London Clay. Despite the close proximity of urban areas, the Country Park is essentially farmland and lowland countryside. Hay-meadows cut once a year in the summer are the major habitat and no pesticides or fertilisers are used. The fields are bounded by a total of about 10km of hedgerows and there are over 20 small ponds. The Country Park also contains mature deciduous woodland, young woodland, scrub and rough grassland.

Methods

The method and examples of the recording forms used have been well

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documented elsewhere (Pollard 1977, Hall 1981, Pollard *et al.* 1986) and only a brief summary is given in this paper.

A 3.2km transect was established at the Country Park to encompass a range of habitats and was divided into 14 sections (Figure 1). Where possible it followed footpaths and hedgerows. To save time the transect was of a circular type, so that the recorder would finish at the starting point. The transect was

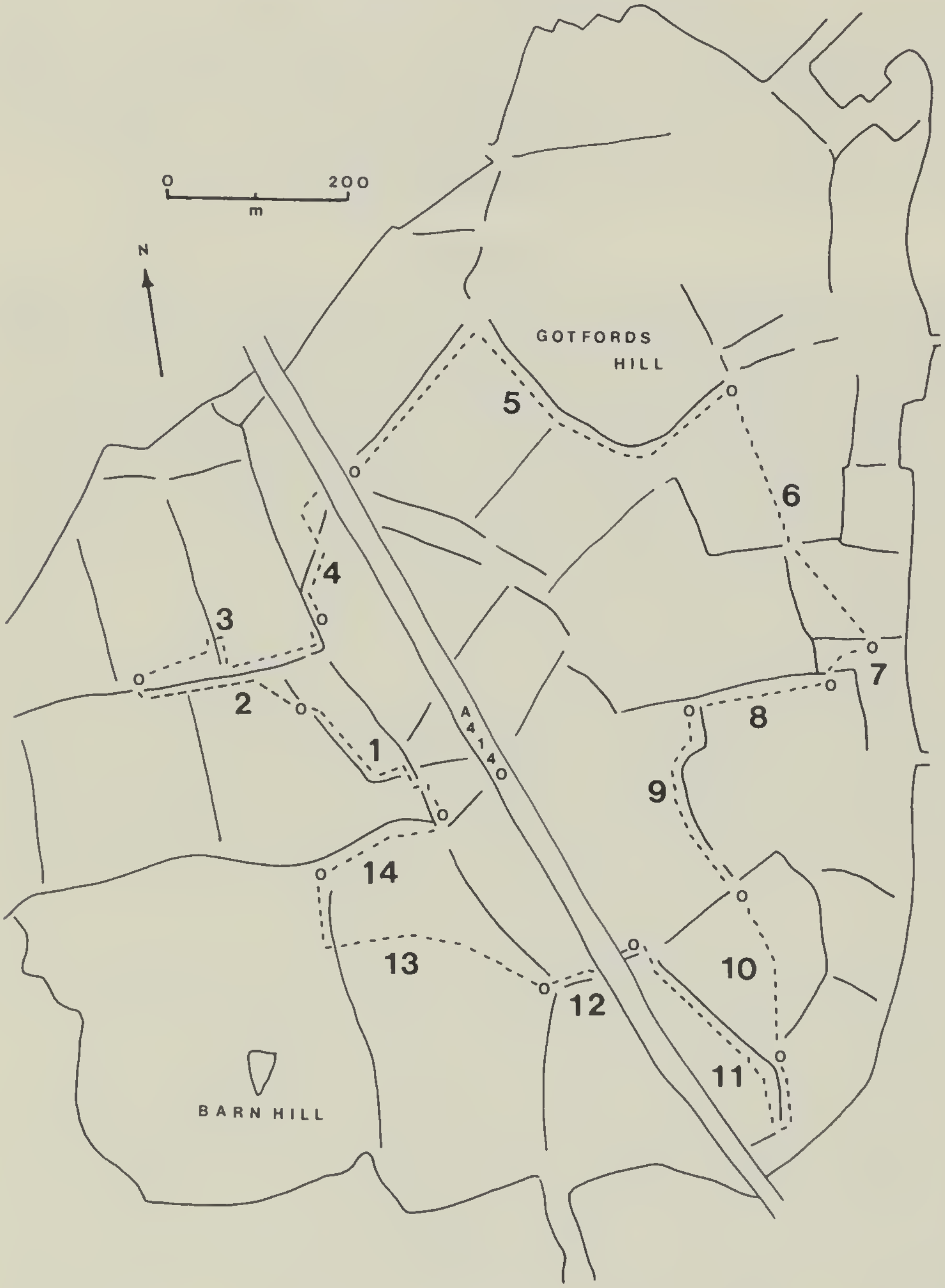

FIG. 1. The butterfly monitoring transect at Fryent Country Park. The main habitats of each section are: 1 – hedgerow/grassland, 2 – hedgerow/grassland, 3 – hedgerow/hay-meadow/scrub, 4 – hedgerow/grassland, 5 – hay-meadow/hedgerow, 6 – hay-meadow, 7 – grassland/hedgerow, 8 – hedgerow/hay-meadow, 9 – hay-meadow/regenerating hedgerow, 10 – grassland/young woodland, 11 – hedgerow/grassland/hay-meadow, 12 – grassland/hedgerow, 13 – scrub/old grassland, 14 – mature deciduous woodland.

walked at a uniform pace and the number of butterflies seen in front of the recorder along an imaginary corridor about three metres wide were counted. Recording commenced in the first week in April and aimed to obtain one count in each of the 26 weeks until the end of September. Records were collected by species and by section. To reduce observer bias, all recording should ideally be undertaken by one observer only. Since this would be impractical a team approach was required: A. Kwissa and L. Williams were recorders in each of the years, while D. and J. Brown joined the team in 1990.

It was important that the transects were walked under similar weather conditions or the results would not have been comparable. Counts were started after 10.45 hours British Summer Time and completed before 15.45 hours. Counts were not made if the temperature was below 13°C; or below 17°C if there was less than 60% sunshine. Percentage sunshine was estimated from the percentage of sections in which the sun was not obscured by cloud. No counts were made if it was raining or if the wind force was greater than 3 on the Beaufort Scale.

Results

A summary of weekly data during the season and data for each section was extracted from the field-sheets for long-term analysis. For weeks when it had not been possible to walk the transect, an estimated count for each species was made from the average of the two weeks immediately either side of that week. The total count for that species provided an index for the abundance of that species on that transect. The index could be compared with those from the same transect in other years, but should not be compared directly with the index from other sites. For those species that produce more than one generation each season, it was possible to subdivide the index to identify the abundance of each generation. Note that the abundance index for any species is not a population estimate although the index should fluctuate in proportion to the population size from year to year. No estimates were made for the section data and these were not analysed for this paper.

Table 1 shows the total index for each species in each year. For those species which had more than one generation, the index for each generation is shown in Table 2. It is possible that a small proportion of individuals has been attributed to an incorrect generation; in particular the division between second

TABLE 1. Annual index values for butterflies on the Fryent Country Park transect. 1986-1990. Note that where the indices have included estimates the totals have been rounded up to the next whole number. Scientific names of species are given in the text. ★ – data for the separate species were not reliable, but the total skipper index was 233.

	1986	**1987**	**1988**	**1989**	**1990**
Essex and small skippers	61	★	174	142	85
Large skipper	48	★	59	173	71
Large white	17	2	15	32	16
Small white	78	9	22	19	15
Green-veined white	44	29	111	89	53
Orange tip	1	10	4	13	31
Small copper	—	6	—	5	23
Common blue	2	1	—	2	11
Holly blue	—	—	—	15	19
Red admiral	—	—	1	—	2
Painted lady	—	—	4	—	—
Small tortoiseshell	25	61	66	54	15
Peacock	9	14	17	8	8
Comma	—	8	7	6	7
Speckled wood	—	16	70	132	91
Wall brown	4	2	—	13	13
Meadow brown	708	2,508	3,502	3,320	2,057
Small heath	31	42	9	26	71

TABLE 2. Annual index values for butterfly generations on the Fryent Country Park transect, 1986-90. I, II and III refer to the generations, s to the spring flight and a to the autumn flight of overwintering adults. For some individuals the identification of the generation was open to question. Note that where indices have included estimates the totals have been rounded up to the next whole number. Scientific names of species are given in the text. For species not listed here, refer to Table 1.

	Generation	1986	1987	1988	1989	1990
Large white	I	7	1	3	3	4
	II	10	1	12	29	13
Small white	I	10	7	16	10	9
	II/III	68	2	6	10	6
Green-veined white	I	25	8	60	16	15
	II	19	21	51	73	38
Small copper	I	—	—	—	—	9
	II	—	6	—	3	10
	III	—	—	—	2	4
Common blue	I	—	—	—	—	8
	II	2	1	—	2	3
Holly blue	I	—	—	—	—	5
	II	—	—	—	15	14
Small tortoiseshell	s	18	13	42	36	9
	II	6	16	23	18	7
	a	1	32	2	—	—
Peacock	s	6	2	15	4	7
	a	3	12	2	4	1
Comma	s	—	—	2	—	3
	II	—	5	5	3	4
	a	—	3	—	3	—
Speckled wood	I	—	—	2	132	91
	II	—	—	17		
	III	—	16	52		
Wall brown	I	—	—	—	2	13
	II	4	2	—	8	—
	III	—	—	—	3	—
Small heath	I	31	41	9	8	50
	II	—	1	—	19	21

and third generations may be difficult to demarcate. For data analysis, the Nature Conservancy Council usually treats any third generation as part of the second generation, while species with a complicated succession of generations are given a single index. Some species produce third generations in years with favourable weather conditions and this appeared to be the case in 1989. However such effects are best studied from the pooled results from several sites. Nineteen species have now been recorded on the transect, though the number of species recorded on the transect each year varied from 13 in 1986 to 18 in 1990. Two other species have been recorded elsewhere in the Country Park, both prior to 1986. Brief species accounts are given below, the order of which follows Thomas (1986).

SMALL SKIPPER *Thymelicus sylvestris*

Both this species and the Essex skipper were recorded on the transect each year. However, where they occur in abundance, it was not possible to separate them on transect counts and the Nature Conservancy Council practice of including data on the two species together has been adopted. Highest numbers were recorded by the thick hedgerows and rough grassland of Sections 3 and 4.

ESSEX SKIPPER *Thymelicus lineola*

Present on the transect but, as noted above, data on this species are included with that of the small skipper.

LARGE SKIPPER *Ochlodes venata*

The flight period of the large skipper is earlier than that of the small and Essex skippers, though in flight it was difficult to distinguish them and there may be some errors in the data.

CLOUDED YELLOW *Colias croceus*

This species has not been recorded on the transect, but one was seen in the Country Park on 26 July 1983 as part of the migration described by Plant (1984).

LARGE WHITE *Pieris brassicae*

It is possible that a small proportion of the *Pieris* species were mis-identified when in flight.

SMALL WHITE *Pieris rapae*

In some years there was evidence of a third generation, or migration in the late summer.

GREEN-VEINED WHITE *Pieris napi*

Numbers were highest in 1988 and this was probably the case elsewhere in London.

ORANGE TIP *Anthocharis cardamines*

The index fluctuated from as low as one in 1986 to as high as 31 in 1990.

PURPLE HAIRSTREAK *Quercusia quercus*

Butterfly transect monitoring was not designed to record this species as it flies high in the canopy of oak trees. None recorded on the transect, but one was seen in the Country Park in July 1984.

SMALL COPPER *Lycaena phlaeas*

Most records were from transects on the west side of the Park. This distribution appears to correspond to that of the two main foodplants, common sorrel *Rumex acetosa* and sheep's sorrel *Rumex acetosella*. Data from hay-meadow surveys suggested that common sorrel was much more frequent in meadows on the west side of the Country Park and sheep's sorrel was almost confined to Barn Hill (Section 13), where it occurred with common sorrel.

COMMON BLUE *Polyommatus icarus*

Recorded in most years, but in small numbers.

HOLLY BLUE *Celastrina argiolus*

The abundance of the holly blue fluctuated greatly from year to year, possibly in response to climatic factors. Although it had been seen in the Country Park in some previous years, it was not recorded on the transect until 1989, a year in which there were considerable sightings in the surrounding urban areas. The 1990 index was also high.

RED ADMIRAL *Vanessa atalanta*

Encountered in very small numbers on the transect, but more frequently in the scrub woodland on Barn Hill.

PAINTED LADY *Cynthia cardui*

Recorded in small numbers in 1988; and elsewhere in the Country Park in 1990.

SMALL TORTOISESHELL *Aglais urticae*

The index varied from a high of 66 in 1988 to 15 in 1990. Generations varied in relative size too. For example, in 1987 the second generation (overwintering adults) was the most numerous with an index of 32, yet this generation was not observed on the transect in 1989 or 1990.

PEACOCK *Inachis io*

Adults may have been more common in nearby suburban gardens than in the Country Park.

COMMA *Polygonia c-album*

Observed from the first week in April to the last week in September. There was evidence of three generations or flights, though only two have been recorded in any one year.

SPECKLED WOOD *Pararge aegeria*

This woodland butterfly appears to have become established at Fryent Country Park in recent years; a phenomenon recorded by the butterfly monitoring. Between 1982 and 1985 the speckled wood was infrequently recorded in the woodland of Barn Hill. In 1986 it appeared to be more frequent, but it was not recorded on the transect which commenced in that year. However, the 1987 index was 16 with most of the records from Barn Hill, but including one from the east side of the Country Park. It was also sighted by hedgerows in the north of the Park. In 1988 the index was 70 including some records from a population in the vicinity of Sections 2 and 3 where there were thick hedgerows and scrub. Other reports of the speckled wood were received from throughout the Park. In 1989 the index rose to 132, though this was a dry year and the index fell to 91 in 1990. Nationally a similar fall was experienced after the 1976 drought (Pollard *et al.* 1986).

The flight period of this species in the Country Park also increased. In 1987 it was seen in the late summer weeks only, but in 1988 three distinct generations were present with the first in May. With the increase in population in 1989 the generations could not be separated as the speckled wood could be seen on the wing continuously from April to late September. This pattern was repeated in 1990.

Much of the management work in the Park is concerned with creating and managing a wide variety of woodlands, each with a network of footpaths, rides and glades. Coppice woodland is also being planted and managed, and should provide suitable conditions for this species. Plant (1987) noted that the speckled wood appeared to be spreading in the London Area.

WALL BROWN *Lasiommata megera*

The wall brown was abundant in 1989 and 1990 compared with the earlier years of monitoring. In 1989 there appeared to be a third generation in late summer.

MEADOW BROWN *Maniola jurtina*

The large population density of this species is remarkable for a site surrounded by London, but supports the argument that the Park is countryside rather than an urban site. To consider the index figures for the Country Park in context reference should be made to data from the national sites in the Nature Conservancy Council monitoring scheme (Pollard *et al.* 1986). Although, as noted above, strict comparisons are not possible, only on a few of these sites did the meadow brown index exceed that for Fryent Country Park. Habitat appears to be the crucial factor, especially the large area of hay-meadows (neutral grassland) which are cut once a year in the summer. The meadows are not fertilised and support a diverse flora including a range of grasses that are the foodplants of the larvae of the meadow brown. It is not known if the date of cutting has any effect on numbers and a similar question has been raised by the Butterflies Under Threat Team (1986). Most of the records were from Sections 5 to 9, corresponding to the main areas of hay-meadows.

SMALL HEATH *Coenonympha pamphilus*
This species was most frequent in Section 5.

Discussion

Butterfly monitoring is a long-term activity and the value of the results increases with each additional year's data. Five years of monitoring provides a baseline of information against which to compare future changes. Pollard *et al.* (1986) summarise considerable evidence to validate the transect-monitoring method. Transect records were made under specified weather conditions to ensure that adult butterflies were not sedentary at the time of survey. Pollard *et al.* (1986) show that providing the transect counts were made during favourable weather conditions, the correlation of the butterfly index with the weather during the count was negligible compared to the correlation with butterfly abundance. Butterfly abundance, however, is assumed to be dependent partly on the index value in the previous year and partly on weather conditions in the recent past.

For most species, the relative fluctuations shown in Table 1 may be similar to those elsewhere in the region. Thus data from individual monitored sites in London could provide information on the annual abundances of butterflies in the London Area. Reliability could be increased if several monitoring sites pooled their data to produce collated indices for each species. Pollard *et al.* (1986) show how these can be calculated and provide collated indices for 1976-85 using data from all their British monitoring sites. Within London only the Hampstead Heath transect is included in the national data and publication of the indices can take up to 10 years. Monitoring the abundance of butterflies in the London Area could be improved if there were more sites and if these were capable of reporting data at more frequent intervals. During recent years several independent transects have been established in the London Area and the surrounding counties. An informal network of these recorders was recently established with the London Branch of the British Butterfly Conservation Society as coordinator of the data pool. The method for calculating collated indices can accommodate additional sites joining the scheme and the possibility that sites could leave the network. It may be noted that transects need not be as long as that at Fryent Country Park to provide useful results.

In 1989 and 1990 it appeared that several species had earlier generations than in 1986-88, sometimes by up to four weeks. Further evidence of the warmer conditions in 1989 were that a few species appeared to have had third generations in the late summer, as compared with the more usual two generations (Table 2 and from records from elsewhere in the Country Park).

Butterflies are also susceptible to changes in habitat and habitat management. Such changes are likely to be local and may show up as anomalies when data from one site are compared with the regional collated index. Consistent increases or decreases over a number of years at one site could also suggest habitat changes. Furthermore, trends from different sections on the same transect can be compared, especially if a section of a site is being managed differently from another section. Butterfly monitoring could therefore be a useful technique for wildlife managers in London.

Acknowledgements

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Book Review

The Butterflies of Britain and Ireland. By Jeremy Thomas and Richard Lewington. Dorling Kindersley and The National Trust, London. 1991. 224pp. £16.99. ISBN 0 86318 591 6.

With the vast number of recently published butterfly books on the market it is a brave man (or woman) indeed who attempts to produce yet another volume. The standard work is, of course, Emmet and Heath (1989) but this has one major disadvantage – the price tag! So, to fill the gap between this and the army of lesser books available, what was needed was a 'standard work' at an affordable price. It is the reviewer's contention that Messrs Thomas and Lewington have admirably plugged this gap with the volume now reviewed.

A brief introduction is followed by a series of three-page accounts of each species – the first section of the book dealing with residents and regular migrants, and the second with rarer migrants, extinct species and so on. One of the three pages for each species is devoted to excellent quality illustrations which are as attractive as they are technically exact. What I find especially valuable is the inclusion of illustrations of butterflies with wings folded – not least because that is usually how they are positioned whenever I see them! Eggs, larvae and pupae are also illustrated for each species and in my opinion are sufficiently accurate to enable ready identification.

The subdivision of the text does not appear to exhibit any great degree of conformity between species, and the headings used are reminiscent of those which litter items of minimal interest in local newspapers in an editorial attempt to attract the reader's attention. But perhaps this does not really matter too much since the content is comprehensive, accurate and, above all, readable.

What we have here then is a thoroughly comprehensive and accurate work on butterflies between hard covers, and at a price which is clearly aimed at the general market rather than at the expert entomologist (though the latter will also wish to posses it). Of all the books on invertebrates that I have seen or been sent for review this year this is the one which earns my personal 'Xmas list' recommendation. Buy it!

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Colin W. Plant

F. W. Frohawk – London Naturalist

By June E. Chatfield*

Summary

F. W. Frohawk (1861-1946) was a naturalist and illustrator known particularly for his work on British butterflies. He lived in the Home Counties of Surrey and Essex from 1873 until his death and witnessed great changes in the area, some of which are recorded in his manuscript memoir.

Introduction

Frederick William Frohawk, zoological illustrator and lepidopterist, lived for much of his life in the area covered by the London Natural History Society within a radius of 20 miles from St Paul's Cathedral. Born at Brisley Hall in Norfolk in 1861, he came to Croydon, Surrey in 1873 residing at various addresses in Croydon and Norwood until 1884 when a financial crisis befell the family. With his brother William he then took rooms in New Cross, London for economy, while his mother and sisters went to a cottage at Eltham in Kent. After the death of their mother in 1887, the brothers and sisters moved to Balham, south London and lived at Dornton Road. F. W. Frohawk married in 1895 and with his wife Margaret moved to Bromley, Kent in 1898, thence to Brighton, Sussex in 1899 returning to Croydon from 1900-1903 when they lived at Waddon Road. In 1904 they moved to Rayleigh in Essex and during that time Margaret Frohawk died. The move back to Surrey and Wallington was associated with his second marriage to Mabel Jane Hart Bowman in 1911. In 1917 they went to Essex to a house called Uplands at Thundersley, but it came up for sale and they had to leave in 1919. The family then went to share a home with Dr A. G. Butler (Keeper of Entomology at the British Museum (Natural History)) at Beckenham, Kent until his death, returning to Surrey and Carshalton in 1925. The final move was to Essendene in Cavendish Road, Sutton in 1927 which remained his home until his death in 1946. These changes of residence are documented in the membership list of the South London Entomological and Natural History Society of which he was a member from 1886.

Further background on the life of F. W. Frohawk is given in *F. W. Frohawk – His Life and Work* (Chatfield 1987) and this includes substantial extracts from his previously unpublished memoir. Additional details on the Croydon area were published in the *Proceedings of the Croydon Natural History and Scientific Society* (Chatfield 1989) and his walks in the north-east Surrey and Kentish countryside in *The Rambler* (Chatfield 1988).

F. W. Frohawk's surviving daughter Valezina, Lady Bolingbroke, is a great admirer of her father's work and she has published two personal memoirs, the first of her recollections of her father (Bolingbroke 1977) and the second of her own life (Bolingbroke 1987), both of which add a vital and personal element to the biographical background of F. W. Frohawk.

Records of London's Countryside

The part of the London Natural History Society's area with which F. W. Frohawk had the longest association was north-east Surrey, around Croydon and Norwood, but he also knew well the London commons and particularly Tooting Bec Common that was close to his home in Dornton Road, Balham. Living in this area for much of the time from 1873 until his death in 1946, Frohawk witnessed great changes with large-scale building development that destroyed former wildlife haunts and linked up previously individual villages

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and hamlets into a massive conurbation of suburbia. Whilst gardens of the built-up areas continue to provide wildlife habitats suitable for some species, and especially the more mobile winged insects, it is clear from his early writing how many species have been lost through habitat destruction. This is well demonstrated in his paper *A List of Birds Observed at Tooting Beck Common Near London* (Frohawk 1894) and in his memoir he records the 'tidying up' activities on the Common and the adverse effect this had on its former wildlife. There was a good list of birds, mammals and herpetofauna and the last included natterjack toads, now a very rare and protected species in this country.

From F. W. Frohawk's memoir:

> Previous to the early nineties of last century Balham and the surrounding district was very different from what it presents at the present time. Therefore I think it may be of some interest to give some rough idea of the various creatures which I met with on Tooting Common (Balham) during the years 1887 to 1894 inclusive, which was then a small piece of natural ground adjoining unspoilt country; but early in the 90s, it was levelled and otherwise "improved" by the authorities, greatly to the regret of the nature lovers and students of the fauna and flora of the district. This exterminated many nesting birds and various other creatures, which had enjoyed a congenial resort amid the former varied vegetation.
>
> Respecting the mammals I observed were the stoat, weasel, rabbit, red squirrel, hedgehog, mole, common shrew, field vole, long-tailed field-mouse, rat and three species of bats.
>
> A very interesting and extremely local inhabitant of the common, was the natterjack toad, I often saw them running mouse-like, to take cover in the rough growth surrounding the pond as I approached their haunts. The birds which frequented the common seen by myself amounted to 75 species, of these 41 nested there or the immediate surroundings. I often came across the common lizard and the slow worm.
>
> Croydon from 1873
>
> The remarkable changes which I have known to have taken place in Croydon and its surroundings during the past 65 years may be worth recording, as an instance of how a place can be ruined of its wildness to those who appreciate the country and the natural beauties of the locality, which teemed with nature's wealth.
>
> In those days, of well over half-a-century Croydon was then an old fashioned country town, with a population of some 70,000 which has risen at the present time [1940] to about 200,000. The built up area from the S.W. to the N.E. then extended to Waddon and South Croydon Railway Station. It was the northern parts of the town where the buildings extended to Thornton Heath, Norwood and Addiscombe, but these places were more or less isolated by meadows and other open spaces.

Frohawk then goes on to recollect the villages, the fine trout in the River Wandle and Riddlesdown with its chalk vegetation and juniper bushes now lost under a housing estate. He recalls partridges by South Croydon Station, red squirrels and pheasants at Crohamhurst Wood, quail at Coulsdon and the richness of the Shirley Hills (also known as Addington Hills) with adders, nightjars and long-eared owls and where he used to catch bank-voles, field-mice, common and pygmy shrews (quotation in Chatfield 1989).

> I found Dormice fairly plentiful in the rough hedgerows and woodlands south of Croydon, mostly in their summer nests. In the woods, especially which was known as Loyds Wood, in the seventies, and til the arctic winter of 1895 The Common or Red Squirrel was numerous. One morning at the end of January 1881 with a heavy snowfall covering everything, I watched four squirrels in a small Hawthorn feeding on the berries, another morning I counted fourteen squirrels in the Larch trees in mid-March in 1882, all were in the edge of Loyds Wood by the roadway. After the winter of 1895 squirrels had greatly decreased in numbers, no doubt the winter proved much too long and severe for them to survive and obtain sufficient food, there were no succulent young buds in the early spring and everything was frozen up until April.

F. W. Frohawk, 1861-1946.

> During the severe winters of 1879, 79-80, 80-81, it is interesting to record the great abundance of Snipe at Norwood, only eight miles from London Bridge ... About 4 p.m. they used to leave the pasture ... to feed on the irrigation fields between Hackbridge and Mitcham.

The snipe were the subject of a note in *The Field* (Frohawk 1886).

> September 1876, we left Croydon to reside at South Norwood. In 1877 the immediate surroundings of South Norwood consisted of rural fields, rough hedgerows and large ponds which were stocked with fish, where I spent days fishing and caught many good sized Rudd and Roach. Also in a long sheet of water, part of the old Croydon canal, were some large Tench of excellent eating if laid in brine over night.
>
> The year of 1877 was outstanding for the invasion of Clouded Yellow butterflies (*Colias edusa*) now named *C. croceus*. In consequence it was named by Entomologists the "Edusa Year". I remember then these beautiful insects fluttering over the clover blossoms growing by the roadsides and fields all over the district.

Frohawk lived in the Croydon area when red squirrels were in several woods and before they were displaced by the introduced American grey squirrel which is the only squirrel now seen in London's countryside. Frohawk's lifespan witnessed this change. Over this long period of time he saw fluctuations and cyclical changes in weather as well as the abundance of animal populations, and his memoir contains much on the weather (Chatfield 1987, 1989).

The following is a transcript of an undated pencil-written letter to F.W. Frohawk from his brother William and on the back is a field-sketch of an adonis blue used for a drawing in *The Complete Book of British Butterflies* (Frohawk 1934):

Monday a.m.

My dear Fred,
Recd. yours first post. You should write to
G.P.O. about delay in that parcel, it was letter
post & the wooden box from here was parcel post.
I told you on my card of Thursday that E.A.P. was
dead and buried. Very pleased to go after Adonis on Wed.
can meet you at Sutton, trains from here to Sutton 9.16
9.58 10.48, they are also Box Hill trains. I know
when Adonis used to occur on the grassy slopes
between Ranmore and Dorking(1)*. Why don't you come here tomorrow*
evening. K(2) *is not here, plenty of room. I am afraid*
I cannot be with you next Sun. as I have eight
dogs here that would be too much to leave to E.(3) *I*
will see you all as soon as I can leave the patients
comfortably. I know that plant, will try & name
it. Am in a hurry now. Would you like me to take
grub &c. for us both on Wed.? if we go, it would be
quite easy.

Loving brother
W. F.

P.S.
Day tickets are issued to Box Hill by most
trains, not all.

L 10.35
a 11.17

Footnotes:
(1). This butterfly occurs (1980s) on the dry chalk rubble slope of White Down near Ranmore – J.C.
(2). Sister Kate
(3). Emily his housekeeper.

On verso is a sketch and note 'Adonis ♀ at rest 3.25 p.m. 21.ix. [?]10 after sunshine clouded over for ½ hour'.

In the letter the times 'L 10.35' and 'a 11.17', which have been added in black ink, are interpreted as referring to the leaving and arriving of trains. William was travelling from Balham and evidently arranging to meet his brother Fred at Sutton.

The letter itself is undated, but the logical time for this excursion would have been the late 1920s or early 1930s when F. W. Frohawk was living at Sutton and working on *The Complete Book of British Butterflies* which could have motivated the excursion to look for adonis blue, especially as this sketch on the verso is used in the book.

There is however an anomaly over the date on the sketch given as 21.ix.10. At that time F. W. Frohawk was living in Essex and that was long before work on his second book. He was however a person of great precision and accuracy and it would have been uncharacteristic of him to have made an error over date. The date given on the butterfly sketch remains a puzzle.

Apart from Frohawk's recollections in the memoir that was written during the last few years of his life, there are biological records for the London Natural History Society Area in print. There are two main sources, one is *The Field* of which Frohawk became first zoological illustrator in 1881 and Natural History Editor in 1907 and the other is *The Entomologist* to which he contributed something virtually every year from 1882 until 1945. Many of the notes in *The Field* feature the popular animal groups of birds and mammals when the recording of atypical forms was much in vogue. A range of examples can be quoted, but it would be a useful activity for someone with ready access to a good run of these publications to scan them for biological records. Whilst some of the notes by Frohawk comment on specimens sent in, others are based on his own field-work and observations.

Some records of butterflies for the London Area can be gleaned from Frohawk's classic books on butterflies (Frohawk 1924, 1934, 1938), both in the text on distribution and in locality data for the plates in *Varieties of British Butterflies*. The descriptions also pick up the changes in abundance of the species. It is interesting to quote a few from *The Complete Book of British Butterflies* (Frohawk 1934):

SWALLOWTAIL

> In the past, when Battersea and Tottenham were rural country districts, the Swallowtail existed in some abundance in the surrounding marshlands.

WHITE ADMIRAL

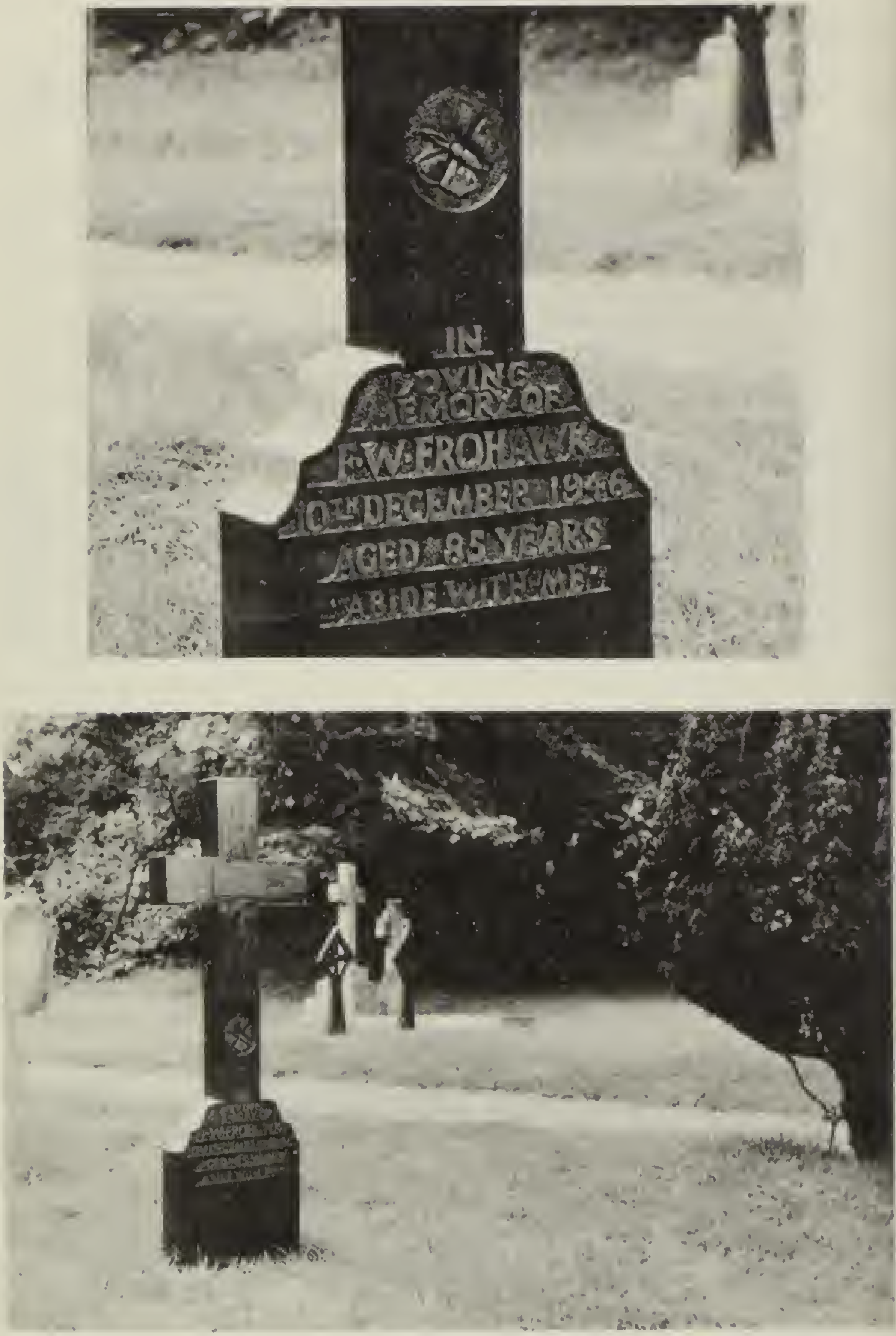
> About a century ago it was a fairly common butterfly in many woods round London ... but during the middle of last century it became less numerous and until a few years ago was confined to a few limited localities.

COMMA

> Until the last four or five years, this elegant butterfly had become during the past half-century very much scarcer than formerly, having from some mysterious cause disappeared from nearly all its former haunts, and became almost wholly confined to the Wye district of Hereford, Monmouthshire and Worcestershire. But from some unaccountable cause, it has, within the past few years, suddenly reappeared in various parts of the southern and midland counties and has now appeared in the outskirts of London, where it has bred and produced broods in a wild state.

CAMBERWELL BEAUTY

> In 1872 it appeared so numerous that specimens were observed throughout the country especially in the eastern counties, extending from Kent to the Moray Firth. In that year, known as the great "Antiopa Year" a large number were captured



The wooden grave cross of F. W. Frohawk with carving of a Camberwell beauty at Headley, Surrey. This new cross is an exact replica of the original from the late 1940s that was commissioned by his daughter Valezina, Lady Bolingbroke, and erected in 1991 to replace the original which was disintegrating. The latter is illustrated in *F. W. Frohawk. His Life and Work*, 1987.

Photos: June Chatfield.

> during one week in August at Shirley, Surrey, being attracted by exuding sap from a clump of ancient oak trees. In 1880 large numbers again occurred in various localities, since when there has been a general scarcity but hardly a year passes without one or more being recorded. It must here be mentioned that for some years past large numbers of this beautiful butterfly have been imported and purposely liberated in different parts of the country especially in the neighbourhood of London, also parts of Surrey and Sussex ... The introduction of foreign examples of any species of British butterflies is a useless and unwise practice, as it completely upsets all records of the appearance of our migratory species.

Some of the butterflies illustrated in *Varieties of British Butterflies* come from the London Area. They are clouded yellow from Finchley, Middlesex 1876, pearl-bordered fritillary from West Wickham, Kent 1887, high brown fritillary from Windsor Forest 1928, red admiral from Erith, Kent 1889, small tortoiseshell near London 1889, holly blue from Sutton, Surrey 1929 (probably his own garden), brown argus from Chipstead, Surrey 1921, chalk-hill blue from Purley, Surrey 1900, orange tip from Fairdean Downs, Coulsdon, Surrey, 1903 and Chingford Mount Cemetery 1898 and pale clouded yellow from Bookham, Surrey 1933 and Wimbledon Common 1892. Although no longer so wild, Wimbledon Common is today designated as a Site of Special Scientific Interest.

F. W. Frohawk was more of a field naturalist than a collector and, like Gilbert White of Selborne, preferred to watch the living animals in the field. However like most entomologists he started collecting insects in his childhood and learned much from having a collection. In later life his collection specialised in British butterflies and bird skins and both were bought by Lord Rothschild in 1927 (Chatfield 1987). The Lepidoptera are therefore with the Rothschild collection in The Natural History Museum, South Kensington. Studies of these and the data labels could yield much further information.

The Natural History Museum holds the original art-work for the *Natural History of British Butterflies* (Frohawk 1924) and for the series of postcards of butterflies and moths commissioned and produced by the Museum. In addition F. W. Frohawk's daughter Valezina, Lady Bolingbroke, has given examples of her father's work at various times, the first accession being in the Zoology Library and the second more recent one (1989) being in the Entomology Library.

Societies

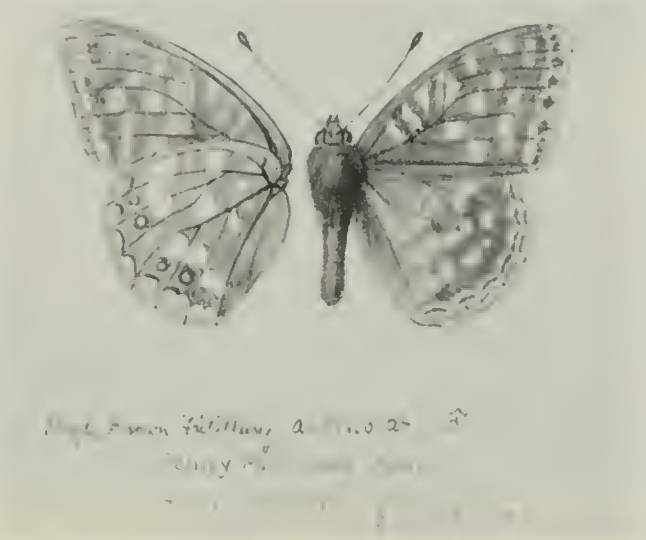
F. W. Frohawk was a familiar face at meetings of the South London Entomological and Natural History Society. He joined in 1886, regularly exhibited at meetings and served on Council including the role of Vice-President. There was a gap in his membership from 1899-1911 and from the *Proceedings* it appears that this may have been due to his disagreement with Tutt (Chatfield 1987) for he significantly rejoins the year after Tutt died.

Frohawk's exhibits at meetings are listed in the *Proceedings of the South London Entomological and Natural History Society* and although there is an entomological bias, he also brought in bird and mammal specimens.

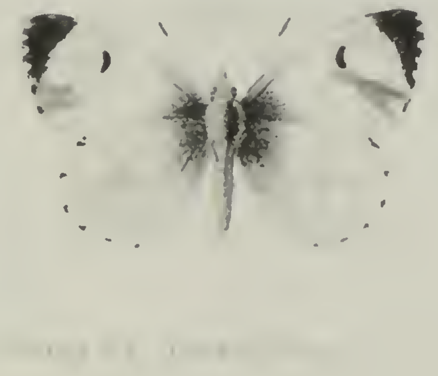
Frohawk was a member of the British Ornithologists' Union and also a member and later special life-member of the Entomological Society in whose journal he published the life-history of the large blue and the role of the ant (Frohawk 1915). He seems not to have been much involved with the London Natural History Society and is only on the membership list from 1931-1936, a period of time when he did not attend meetings so frequently. The earlier history of the London Natural History Society had its emphasis on north London whilst Frohawk lived south of the Thames and was in the catchment of the South London Entomological and Natural History Society, which was possibly stronger on entomology.

A Selection of Drawings by F.W. Frohawk

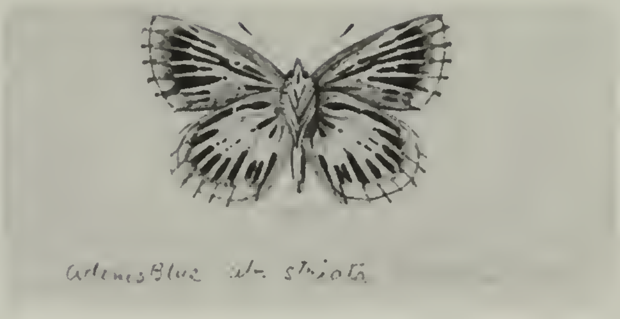
The illustrations which follow are selected to show examples of the work of F.W. Frohawk relating to specimens found in the Home Counties. The first four are final artwork, while the others are rough pencil sketches to be redrawn and used at a later stage. Some were used in *F.W. Frohawk: His Life and Work* (Chatfield 1987) and also in *The Complete Book of British Butterflies* (Frohawk 1934).



Male high brown fritillary *Argynnis adippe*, rare aberration *albino*, from Penny Pat Wood, Kent, 7 July 1888. This specimen was from the Zoological Museum, Tring and the illustration was used in *The Complete Book of British Butterflies.*

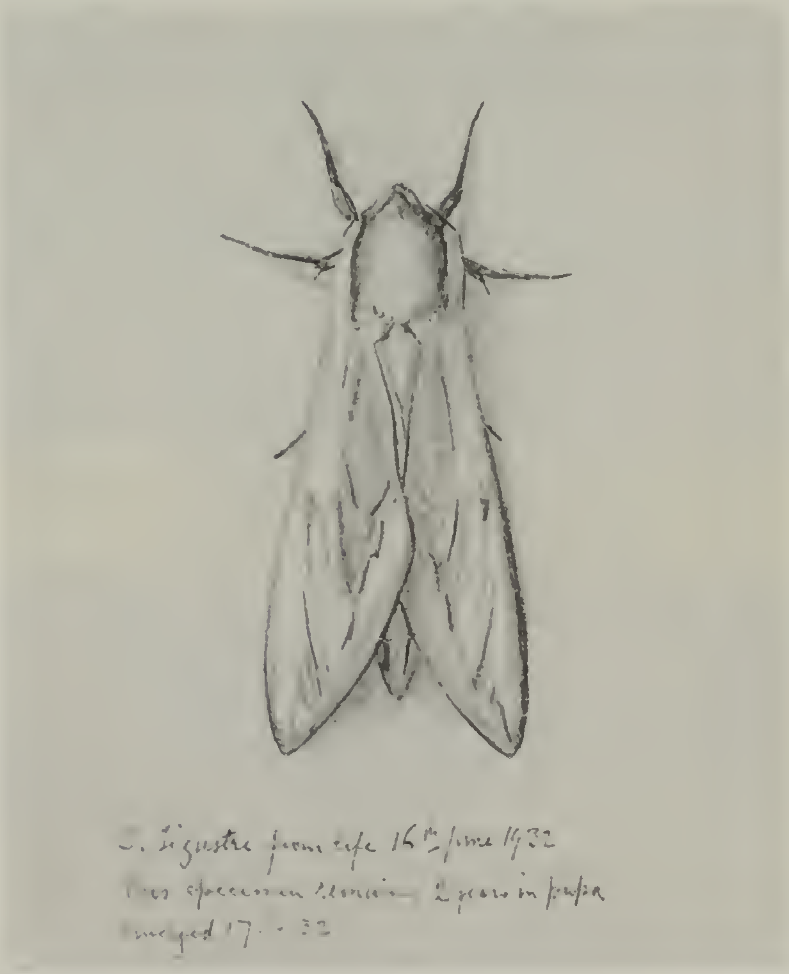


Gynandromorphus example of the orange tip *Anthocharis cardamines*. 'Very occasionally gynandro-morphus examples, having dashes of orange colouring on one or both fore wings occur, but complete gynandrous specimens are exceedingly scarce.' (Frohawk 1934).



Adonis Blue ab. striata

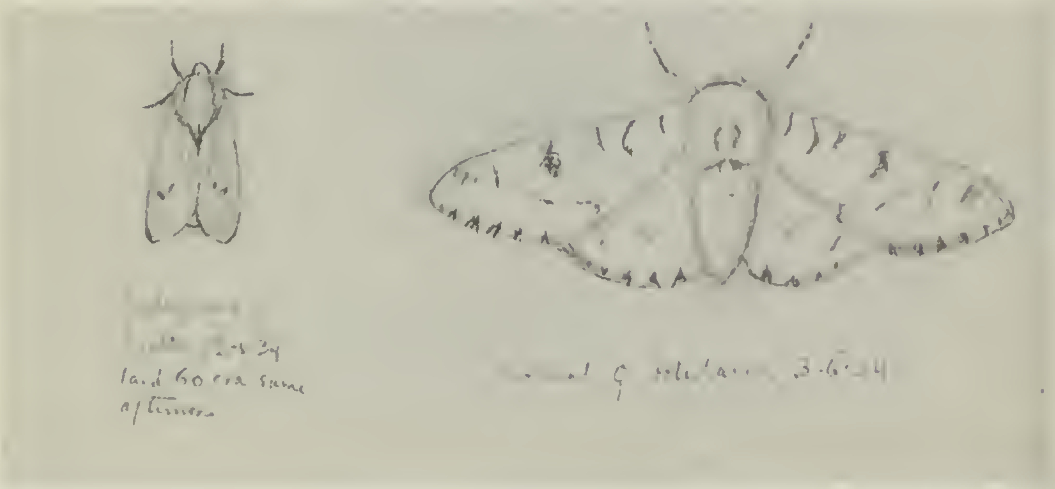
Adonis blue *Lysangra bellargus*, aberration *striata* from Folkestone, Kent, 1900.



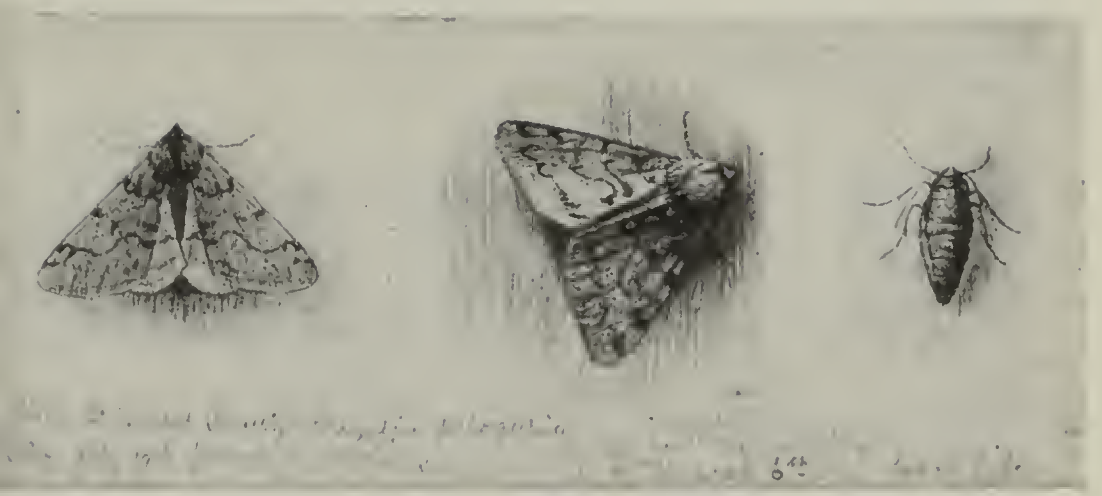
S. ligustri from life 16th June 1932
this specimen remained 2 years in pupa
emerged 17 · · 32

Privet hawk-moth *Sphinx ligustri* drawn from life, 16 June 1932. This specimen remained two years as a pupa. Much of Frohawk's research revolved around breeding Lepidoptera. There is a discrepancy between the day of emergence and the day of drawing as indicated by Frohawk. Logically the specimen emerged on the 16 June and was sketched the following day.

Sketch of purple emperor *Apatura iris* just emerged at 12.30 noon, 27 June 1903.



Sketches of (left) the ruby tiger *Phragmatobia fuliginosa*, Sutton, Surrey, 12 May 1934 – 'laid 60 ova same afternoon', and (right) the normal form of the peppered moth *Biston betularia*, 3 June 1934.



Pale brindled beauty *Phigalia* (now *Apocheima*) *pilosaria* at rest on palings and sketched from life, (left) 19 February 1881, (centre) 6 March 1881, and (right) female, 6 March 1881.

Sketch from life of the goat moth *Cossus cossus* (formerly *ligniperda*), Sutton, Surrey, 4 July 1932.

Acknowledgements

I am most grateful to Valenzina, Lady Bolingbroke, for sharing her knowledge of her father's life and work and for the use of the illustrations currently in her ownership. Mr Keith Hyatt has kindly helped in checking the dates of Frohawk's membership of the London Natural History Society.

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**F. W. Frohawk – His Life and Work* is now out of print, but the author has acquired the publisher's remaindered stock of this colourful illustrated hard back book of 184 pages which is available at £8.50 including postage from Dr J. Chatfield, Anglefield, 44 Ashdell Road, Alton, Hampshire GU34 2TA. Ed.

Book Reviews

Naturalists' Handbooks. Guides for the exploration of British natural history. Richmond Publishing Co. Ltd., Slough. Series editors Sarah A. Corbet and R. H. L. Disney.

To date 16 titles have been published in this series. The first seven were published originally by Cambridge University Press, but all are now obtainable from Richmond and are available in either hardback (£13-£16) or paperback (£7.95-£8.95) form, the number of pages governing the price. All are A5. They are written by specialists, but are aimed at a broad range of readership, from inexperienced naturalists, to school and university students and professional ecologists. They have all been highly recommended by reviewers. Our own recorder for dragonflies, Steve Brooks, writing in the *Journal of the British Dragonfly Society*, considered that 'Dragonflies' was 'Quite simply one of the best books on dragonflies that I have read'. I myself reviewed 'Animals of the Surface Film' for *Natural History Book Reviews* and was very impressed by its content. A reviewer of 'Bumblebees', writing in the *Bees, Wasps and Ants Recording Scheme Newsletter*, said that it 'contains probably the best illustrations of British bumblebees ever published'. The volume on 'Mosquitoes' contains coloured plates by the legendary and illustrious Italian entomological illustrator A. J. E. Terzi (1872-1956), who worked at the Natural History Museum in London from 1902 for over 50 years. They are indeed an impressive series and the standard of illustration, both in colour and black and white, is high.

The full list of titles to date is – 1 'Insects on Nettles', 2 'Grasshoppers', 3 'Solitary Wasps', 4 'Insects and Thistles', 5 'Hoverflies', 6 'Bumblebees', 7 'Dragonflies', 8 'Common Ground Beetles', 9 'Animals on Seaweed', 10 'Ladybirds', 11 'Aphid Predators', 12 'Animals of the Surface Film', 13 'Mayflies', 14 'Mosquitoes', 15 'Insects, Plants and Microclimate', 16 'Weevils'.

K. H. Hyatt

Spider Records for the London Area for 1990-1991

By J. Edward Milner*

Introduction

Compared with last year's find of *Zodarion italicum* in London, the year has been less spectacular, but of the three species new to London county two are quite large. One of them, *Alopecosa cuneata*, is beautifully marked and easily recognisable in the field. It is one of the larger wolf-spiders, a dark chocolate colour with a well-defined, straw-coloured V on the abdomen. The tibiae on the front legs are very much enlarged, being almost barrel-shaped. It is surprising that such a striking species should have been overlooked on Hampstead Heath, which is one of the best-known sites in the London Area. So far all the specimens have been taken from one small part of the Heath which may explain why it has not been recorded before.

The second new record for London, *Agroeca inopina*, is also quite a large species, but is indistinguishable in the field from *A. proxima*, a reddish and rather thick-set clubionid which is found quite commonly in the winter months at Barnes Common.

The third new record for London is the diminutive *Hahnia nava* which has been recorded at Barnes Common and Streatham Common.

The only new record for Middlesex is the attractive crab spider *Diaea dorsata*, recorded by Edward Albin at Hampstead Heath in 1736, but not seen there in recent years. A single male on Ruislip Common in summer 1991 is the only record for Middlesex so far.

The details of these and other interesting or scarce finds in London and Middlesex are given below.

All records are by the author, unless indicated otherwise. Identifications have in most cases been confirmed by Dr Peter Merrett, to whom I would like to express my gratitude. The names used follow Merrett *et al.* (1985).

In the text below new records for London county are marked * and those for Middlesex **. Localities are for Middlesex (M) or London (L) counties.

DICTYNIDAE

Dictyna latens is given as recorded for both London and Middlesex in *British Spiders* Vol. III, but no specific localities have been identified. In early July however males and females were swept from heather and other vegetation at Poor's Field on Ruislip Common (M).

DYSDERIDAE

During the year *Dysdera crocata* has been recorded from a number of new sites, including Hornsey Railway Land where it is quite common, the glade at Coldfall Wood (both M), and at Primrose Hill (L). It is frequently found at Barnes Common (L), whilst in December a single male of the slightly smaller *D. erythrina* was trapped in the same area.

GNAPHOSIDAE

Zelotes latreillei has been recorded at both Hornsey Railway Land (M) and Monken Hadley Common (M); these are the first specified localities for the species in Middlesex since *British Spiders* Vol. III. A male and a female *Z. apricorum* were trapped in the glade at Coldfall Wood (M). Although *British Spiders* Vol. III lists this as a Middlesex species this is the first specified locality.

---

*80 Weston Park, London N8 9TB.

CLUBIONIDAE

A single *Agroeca inopina** male was trapped on the north side of Barnes Common (L) in December: the related *A. proxima* is quite common on the south side of the Common in the winter months.

THOMISIDAE

The single male *Diaea dorsata* was swept from heather and other vegetation including gorse on Ruislip Common (M) in July.

A male *Xysticus kochi* was trapped on Hornsey Railway Land (M) in May and a female *X. erraticus* was shaken from grass at Monken Hadley Common in December; neither was a new record for the county, but they are the first specified localities in Middlesex.

Oxyptila praticola was taken in three lcoalities in Middlesex; a female at Big Wood, Hampstead in May, a female at Coppett's Wood in January, and a male in a pitfall trap at Queen's Wood in June (all M).

LYCOSIDAE

Pardosa palustris (previously *P. tarsalis)* and *P. pullata* have both been taken at Primrose Hill. These records are remarkable for being the nearest records for any lycosids to the centre of London except for *Pirata piraticus* and a single *Pardosa prativaga* at Camley St Nature Reserve. The open spaces in central London are perhaps too disturbed for lycosids to thrive or even survive. *P. palustris* has also been found in some numbers at Gillespie Park Nature Reserve (near Finsbury Park).

The spectacular lycosid *Alopecosa cuneata* has been found to be common in one area on the south side of Hampstead Heath. Nearly 20 males and females have been trapped there in June and early July. The area is sandy, covered with short grass and occasional clumps of rushes. As part of an ecological survey instigated by the Corporation of London, traps are at present (July 1991) set in various parts of the Heath, but *A. cuneata* has not so far been found elsewhere.

AGELENIDAE

Coelotes terrestris (nationally a Notable B species) is widespread in woods in the London Area: the most recent record is from One Tree Hill, Southwark (L) where it appears to be common.

HAHNIIDAE

A single female *Hahnia helveola* was taken at Coldfall Wood (M) in an area that has recently been coppiced. *H. nava** has been trapped on Barnes Common: a male in May and a female in June. At Streatham Common two males have been trapped in June.

THERIDIIDAE

A female *Achaearanea lunata* was taken at Coldfall Wood in May and both sexes were taken at Darland's Lake Nature Reserve in June.

Enoplognatha thoracica has been trapped at Coldfall Wood in May and June, and several males have been trapped on Streatham Common (L) in June and July.

TETRAGNATHIDAE

Correction: Specimens of *Tetragnatha pinicola* were reported by the author in *L.N.*69: 116 as having been swept from bushes at Putney Heath. However, after the journal had gone to press it was realised that a serial number error had occurred: the specimens were collected at Parkland Walk which is just outside the London county boundary in Middlesex. The species is still not recorded from London county.

LINYPHIIDAE

A single male *Ceratinella brevipes* was taken in a pitfall trap at Coldfall Wood in June. *Walckenaeria cucullata** has been omitted from earlier lists, but it has been recorded from Sydenham Hill Wood (L) (a collection identified by Peter Harvey, pers. comm.), Barnes Common, Putney Heath and Hampstead Heath: males in March and April and females in May. Several males and a female of *W. atrotibialis* were trapped at Barnes Common in July. The only previous recorded locality was Hampstead Heath (Russell-Smith 1978). *W. unicornis** has been recorded from Sydenham Hill Wood, and both sexes from Putney Heath in May.

The first record of *Dicymbium nigrum s.s.*** for Middlesex was a single male shaken from grass at Stanmore Common. A first specified locality for *Entelecara acuminata* in Middlesex was recorded when specimens of both sexes were taken at Darland's Lake Nature Reserve in June.

The first specified locality for *Hypomma bituberculatum* in London County was recorded when several males and females were trapped on Hampstead Heath in June.

The first specified locality in London was recorded for *Gonatium rubens* when Mr C. B. Ashby (then President of the Society) took a single female from heather litter on Putney Heath during the Society's field trip there in December 1990.

A female *Tapinocyba praecox* was trapped at Putney Heath in December, and in the same month a male was taken at Monken Hadley Common (M). This tiny rather pale-coloured spider is probably under-recorded in the London Area as it is easy to overlook when sorting vegetation or litter. Males and females of the closely related *T. insecta* were trapped in deep woodland litter at Kenwood in October. It was previously recorded from the same area by F. R. Wanless (Milner 1987).

Panamomops sulcifrons, the tiny horned spider, has been found at two new localities in the London Area. Several specimens, mostly males, were trapped at One Tree Hill, Southwark (L) and at Crouch End Open Space (M), both in May. A male and two females of *Porrhomma microphthalmum* were taken in traps at one site on Hampstead Heath in June; this is only the second London county locality for the species. *P. campbelli*, previously taken by the writer on Hampstead Heath in 1985, was found on another part of Hampstead Heath (a damp part of South Meadow) also in June.

Adding these records to the lists already published, the latest figures for the two counties are London 240 species and Middlesex 262 species.

In London there are now very few open spaces that have not been investigated at least in a preliminary way so fewer new records can be expected in future. Furthermore a number of the species on the list have not been seen in London for some years: 11 species for London and 42 for Middlesex that are given in *British Spiders* Vol. III have no specified locality and have not been recorded since then.

In Middlesex there are still many relatively undisturbed semi-natural sites which have yet to be investigated and further additions to the species list are likely.

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Book Review

The Living River. A Photographic Journey. By David Boag. Blandford Press, London. 1990. 160 pp. 167 colour photographs. £16.95. ISBN 0 7137 2123 5.

David Boag has already made his mark with *The Kingfisher* and *The Atlantic Puffin*, and the photographs in this, his latest book, are of the same very high standard.

The author explains in a Preface that he has not confined his attention to any specific river, and he has not identified any of the locations illustrated. The text is almost entirely related to the photographs. The chapters follow a logical sequence, starting with 'The Source', for which a moorland scene has been selected. This is followed by 'Tumbling Water', in which the dipper and the grey wagtail are featured. The third section is entitled 'Pond and Stream'. The author admits that most natural ponds are completely self-contained, but points out that man-made ponds may be fed by a stream or may drain into one. We can accept his excuse. The stream becomes 'The Lowland River' with its waterfowl, kingfishers and purple loosestrife, and finally we reach 'The Estuary' with its sea purslane, shelduck, crabs and cormorants. Considering the importance of this habitat to the survival of wintering and migratory waders, it is odd that this group is only represented by a single oystercatcher. The author does mention that the higher forms of animal life are dependent upon the invertebrates in the estuarine mud, but there is no suggestion that this ecosystem is under threat.

No reference is made anywhere, in fact, to man's destructive activities. This is a photographic idyll, presenting a world where industrial and urban pollution, eutrophication, land-drainage, culverting, canalization and the effects of excessive abstraction do not exist. Nor do man's buildings appear in any of the landscapes, not even a picturesque old water-mill or a lichen-encrusted mediaeval bridge.

The text is pleasantly free of typographical errors – unless one counts 'bewick's swan' and 'canada goose'. The former also appears without its capital 'B' in the index. Here 'Bulrush' has acquired an additional 'l', while the pintail, although featured on p.140, is omitted altogether.

There are a few other slips. The yellow skunk cabbage *Lysichiton americanum*, described as 'the large cuckoo pint', seems an inappropriate plant to include in the chapter on 'Tumbling Water', even if it does make a fine photograph. It is indexed as 'Cuckoo pint'. 'Hare's tail' (p.14) is the vernacular name for *Eriophorum vaginatum* and not the common cotton-grass, the species illustrated. The 'common blue damselfly' shown on p.55 is, in fact, the blue-tailed damselfly *Ischnura elegans*. The southern hawker *Aeshna cyanea* on p.76 is said to lay its eggs in water, whereas it usually does so at the water's edge, and the nymph's grasping labial appendages are usually described as 'movable hooks', not as 'claws'. Pintail and pochard do not nest *in* freshwater, shaggy ink caps are not fungi of water-meadows – the 'water-meadow' illustrated could be more accurately described as willow carr – and one can hardly say that the young cuckoo *adopts* the reed warbler as its parent.

These are minor blemishes, however, and they do little to detract from the sheer beauty of the photographs.

W. G. Teagle

Distribution and Status of Reptiles and Amphibians in the London Area

By Tom Langton*

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Summary

Records of native reptiles and amphibians from within 20 miles of St Paul's Cathedral are mapped and described for the first time in the history of our Society. Observations are made on these records and on the past and present status of the species. Records are considered in two recording periods; all records made before January 1980 and records made between the start of 1980 and the end of 1990.

Introduction

This is a review of records of snakes, lizards, frogs, toads and newts (collectively known as herpetofauna) seen within our Society's recording area. There is some mention of exotic amphibians and reptiles that have occurred, but the emphasis is on the longer-established, native species rather than those that are escaped or released pets. In some cases escaped or released animals may have bred for one or two seasons, but with the exception of anurans (frogs and toads), introduced amphibians and reptiles do not appear to have formed permanent and spreading populations. They have not established in a way that other types of introduced wildlife have. A few records of native herpetofauna are no doubt released or escaped individuals that were taken from the wild elsewhere in Europe. These may not have been differentiated as they are so similar to native animals. This may particularly occur with species that have been widely traded, such as grass snakes. Some records may be of recently translocated native species from both within and outside the London Area. Surprisingly, maps of herpetofauna within the largest L.N.H.S. recording area have only ever been produced for common frog *Rana temporaria* and common toad *Bufo bufo* (see Yalden 1967 and Burton 1976).

In preparing this review, it did not seem practical to publish a list of every new 1km record, though I would seek opinion on this from members. There is also the question of confidentiality for the records of rarer and declining species. This matter was discussed after my address to the Society for The Parmenter Lecture in May 1991. Instead, I have extended the record-card index system instigated by Yalden (1965). This now has a numbered card index for records so they can be matched with the original source of information. This archive of record sheets and correspondence occupies most of a four-drawer filing cabinet.

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*12 Millfield Lane, London N6 6RA.

I am planning to put the information on a computer so that it may more easily be cross-referenced with other site-based information.

Sources of Records

This review includes all L.N.H.S. members' records though these are only a small percentage of the total. At some later date additional records may be added from sources I have missed. Records of species have only been accepted with a record date and a 1-km Ordnance Survey Grid Reference, preferably a six-figure reference. As well as being the Society's current recorder of reptiles and amphibians, I was employed as a surveyor by the Fauna and Flora Preservation Society/Greater London Council-funded 'London Pond Survey' in 1983-84. I have also made my own observations of the herpetofauna in London over the last 15 years. Those whom I have accompanied in the field and those who have provided results from their own local surveys are listed in the acknowledgements to this review. Records have been extracted from contributions published in *The London Naturalist* and from other journals, reports and unpublished literature.

Previous recorders of reptiles and amphibians in the L.N.H.S. recording area have often reported in a general manner without reference to the precise location of sightings. Town or district names or the names of large, well-known sites were sometimes used. More recently, the use of at least six-figure grid reference records has become an important component of species recording and in particular for use in strategic planning and conservation efforts for declining species and habitats. Table 1 summarises the appropriate numbers of both general and detailed (1-km) records found in the more substantial listings of species records that have been published. This gives a rough indication of the number of records published over the last 90 years and demonstrates the approximate level of precision in the records reported. The trend of increase in the number of records probably partly reflects an increase in the general interest in these species during the 1980s. New wildlife legislation has also kindled government funding of work concerning herpetofauna. One example of this is the short-lived funding of crested newt survey work in the 1980s by the former Greater London Council.

TABLE 1. Authors and dates of reptile and amphibian records and reviews with approximate numbers of records concerned.

Author	Date	Approximate number of general locations of records of species	Approximate number of definite 1-km records of species
Fitter	1949	112	—
Fitter	1960	19	—
Yalden	1965, '67	332	318
Hall	1978	11	—
King	1979, '81, '83	96	71
Langton	1991	—	3,581

TABLE 2. Sources of information for records in this review.

Source	Date	Approximate number of 1-km species records
Previous records from *The London Naturalist*	Pre-1980	465
L.N.H.S. members' records	1981-1990	171
F.F.P.S./G.L.C./London Pond Surveys	1980-1984	559
F.F.P.S./L.W.T. 'Frogline'	1986	200
Other sources*	1980-1990	2,186
Total		3,581

*Sources include smaller local surveys, local natural history society publications and reports, information from scientific journals and reliable records from miscellaneous sources.

Table 2 shows the sources of information for records analysed during the compilation of this review.

The Species and Their Habitats

General

The L.N.H.S. area now has nine of the 12 terrestrial species of herpetofauna widely considered to be native to Britain. The other three species, sand lizard, smooth snake and natterjack toad, have been recorded in the south of the L.N.H.S. area, but briefly and generally lacking detail for their definite past status to be easily assessed.

The extant native species in the L.N.H.S. area in 1990 are:

REPTILES	**AMPHIBIANS**
Grass snake	Common frog
Adder	Common toad
Slow-worm	Crested newt
Common lizard	Smooth newt
	Palmate newt

These species have been generally described elsewhere and my more recent references will lead the inquirer to studies and monographs (*e.g.* Smith 1973). As might be expected for these very widespread species, much literature is in other European languages. There are also several popular publications, booklets and reports in English, and some of these are listed in the references.

Introduced species that are capable to some degree of surviving, breeding and colonizing include species and hybrids of the European green frogs and in particular:

edible frog *Rana esculenta;* pool frog *Rana lessonae;* marsh frog *Rana ridibunda.*

Species from North America that may survive outside captivity for several years but usually die without breeding are the red-eared terrapin *Trachemys scripta elegans* and the North American bullfrog *Rana catesbeiana*. These species may however survive if the habitats are 'gardened' to nurture them, but suffer from the cooler spring and summer temperatures than those found in their native areas. This may impede mating, egg survival, hatching of eggs, growth of young and probably feeding activity as well. Similar restrictions inhibit the colonization of the European wall lizard *Podarcis muralis*, the European pond terrapin *Emys orbicularis*, the European tree frog *Hyla arborea*, and newts of the genus *Triturus*, though some species have persisted and bred for some years before dying out (*e.g.* Stiles 1978).

Reptiles

Reptiles need open, less-wooded areas than amphibians with sunny aspects and lack of disturbance, in order to bask. A variety of open scrubland, *Calluna vulgaris*-dominated heathland and grasslands are known to provide suitable basking areas. Reptiles may also be found in areas near to undisturbed derelict buildings, rubble heaps and scrap metal where there are plenty of artificial refuges, and sometimes abundant invertebrate and vertebrate prey.

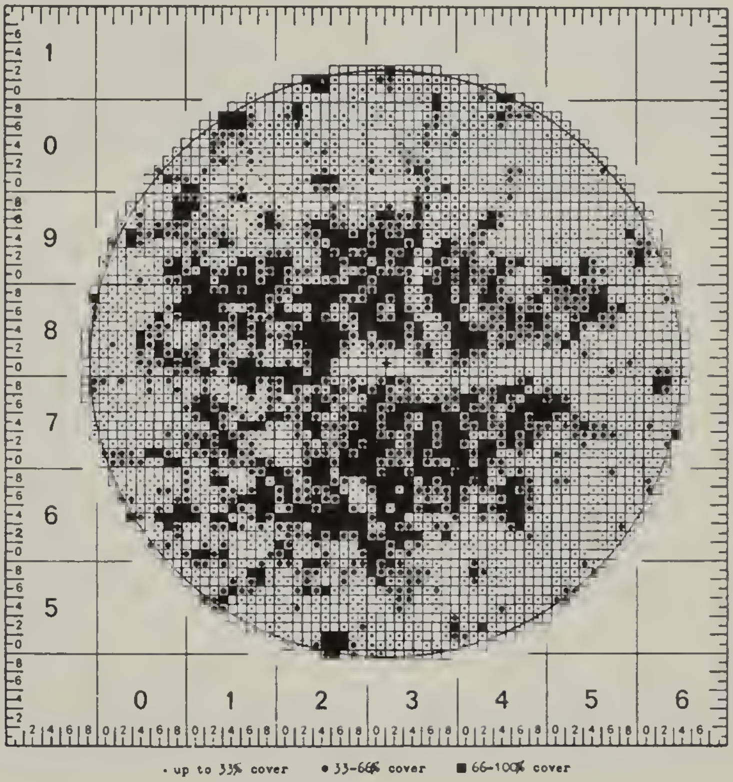
Snakes may move a considerable distance to find food and shelter and enter wetland and woodland edges for such purposes. Lizards are less mobile, but may quite regularly shuttle tens of metres up and down linear features such as railway lines to get to the best basking, feeding and overwintering areas. Both snakes and lizards may move under discarded metal, wood, plastics, glass, cloth and other materials that retain heat from sunlight, both for refuge and to raise body temperature faster at reduced risk of predation.

The large territories required by snakes may be one of the major explanations for their decline in the L.N.H.S. recording area. Reptiles will use gardens, but in a far more transient manner than amphibians as they may be easily scared away or killed by humans, domesticated animals and rats. The most frequently reported use of gardens by reptiles seems to be of a grass snake hunting for amphibians or fish in a garden pond, or a slow-worm and grass snake present in or on top of compost heaps.

Amphibians
The habitats of amphibians include still, fresh water for breeding. Common toads and occasionally other species breed at the edges of slow-flowing rivers and large waterbodies are used. On land amphibians may use many forms of grassland and woodland. In general, they seem to occur in highest density where there is a deep litter layer and other features such as dead wood and rock piles with dense ground cover that provide shelter, a high degree of humidity and a productive food source. Areas of domestic gardens appear to mimic the favoured natural land habitats of amphibians. Heavily mown or grazed grassland with thin topsoil may be less suitable and even be avoided by amphibians, particularly on soils such as gravel. In almost every situation where ditches that hold unpolluted standing water (now quite rare in London) and ponds, occur next to a semi-natural land habitat, the commonest species are potentially capable of surviving. The use of plastic and butyl pond liners and pre-cast glass fibre and plastic garden ponds in domestic gardens has probably increased the surface area (but not volume) of standing water in the L.N.H.S. area over the last 30 years, though the loss of an estimated 90% of London's deeper, older (mainly farm and horse) ponds over the last 130 years (Langton 1985) indicates that there has been a period with very rapid change. Loss, change and fragmentation have occurred to aquatic systems that may have initially reflected their surrounding communities and the local sources that colonised them.

To give some preliminary quantification of garden ponds as a factor in amphibian distribution, Map 1 shows each 1 km of the L.N.H.S. recording area and the approximate cover of areas with houses and gardens (including access roads) in each square. A cursory analysis of Ordnance Survey maps (last revised in the 1970s) suggests that private gardens make up about one sixth or about 530 of the 3,270 sq. km of land in the recording area. Gardens are now one of the largest types of habitat in the London Area. The distribution and density of gardens will be of interest to those concerned with animals and plants that are found in gardens. I have examined numerous 1 km maps of areas in London. Of a sample of nine different 1 km squares covered completely by homes, gardens and access roads, it was found that there are between 139 and 1,680 individual gardens. Seven 1-km squares had between 361 and 774 gardens per km^2, averaging 595 gardens per 1 km^2 and I believe that this seems a more typical density.

From these figures, a very rough estimate of the number of garden ponds within the area can be derived. My knowledge of London suggests that garden pond density varies greatly; in some areas almost every garden seems to have a pond of some kind while in others they are rarer. Larger buildings tend to have bigger gardens and bigger garden ponds and sometimes large, old neglected ornamental ponds or swimming pools that are used by amphibians. The character and size of gardens also varies from inner urban London to outer suburban types. Beebee's (1979) findings for Brighton showed that garden pond density there averaged 200 garden ponds/1 km square with just over one amphibian pond per 20 gardens. Applying this ratio suggests that there may be about 106,000 garden ponds in London, of which about 16,000 have one or more species of amphibian. Langton (1985) found approximately 1,600 larger ponds (ponds over 5-metre span, and mostly over 8-metre span) within Greater London. Thus the availability of amphibian habitats is still relatively large. One notable change since the last century however must be the shortened life span of modern ponds. Smaller garden ponds have a life span measured usually in 10 years or less, while bigger ponds last longer. Smaller ponds are more likely to have natural linings and be less susceptible to puncture and weathering. Another change is the reduction in size of the land habitats surrounding ponds. This results in smaller amphibian populations. The loss and fragmentation of woodlands and grasslands in the London Area seems to be continuing. A recent example of this was the building of the M25 London Orbital Motorway that divided several woods and grasslands and covered numerous ponds.



Map 1. London garden distribution. Approximate cover of houses and gardens in the 1-km squares of the L.N.H.S. recording area – the London Area.

Species Accounts

Records are presented for native species according to two recording periods, pre-1980 and 1980-1990.

The Past and Present Status of Species

This report does not review the habitat requirements and conservation needs of the species. In some cases these can be found elsewhere in the literature, although there has been no comprehensive review for all of the species. However, it does seem valuable to consider the nature of likely changes in abundance of the species over the years, as records produce patterns that can be considered in the light of existing knowledge of each species and their requirements. I have added some brief observations that relate to the conservation of each species. The interpretation of these records is my own, but I have attempted to make this review as factual as possible. Dangers in interpretation of records as a measure of species status include the problem that they may be a biased sample of the actual status. The species each have different levels of natural abundance and secrecy and so comparisons between species can be difficult. Recorder bias is always an important factor to consider, with groups of keen, local observers giving comprehensive treatment to small areas while other areas go unvisited (Burton 1976).

I am satisfied that recording effort post-1979 has overall been quite even for amphibians at least in the Greater London area and not too biased. Sightings of snakes and lizards are now more likely to be followed-up by more-informed observers, though surveys for reptiles have been less organised than for amphibians. In addition to this, there has been much new habitat survey work in the London Area and this has sometimes shown up small, suitable-looking sites. In some cases these have been revisited, with varied results, but with several new records of herpetofauna.

The total numbers of records for all species are shown in Table 3. However, the division of records into the two date categories emphasises the locations of sites that are more likely to still hold populations of herpetofauna. The combined records shown on Maps 2 and 3 indicate places where herpetofauna were recorded some time ago, but not recently, and where their continued presence could be rechecked.

TABLE 3. Numbers of records for each species considered in this review.

Species	Number of records Pre-1980	Number of records 1980-1990	Totals
Common frog	320	827	1,147
Common toad	305	319	624
Crested newt	62	149	211
Smooth newt	188	506	694
Palmate newt	27	60	87
Grass snake	140	107	247
Adder	43	32	75
Slow-worm	98	122	220
Common lizard	189	87	276
Totals	1,372	2,209	3,581

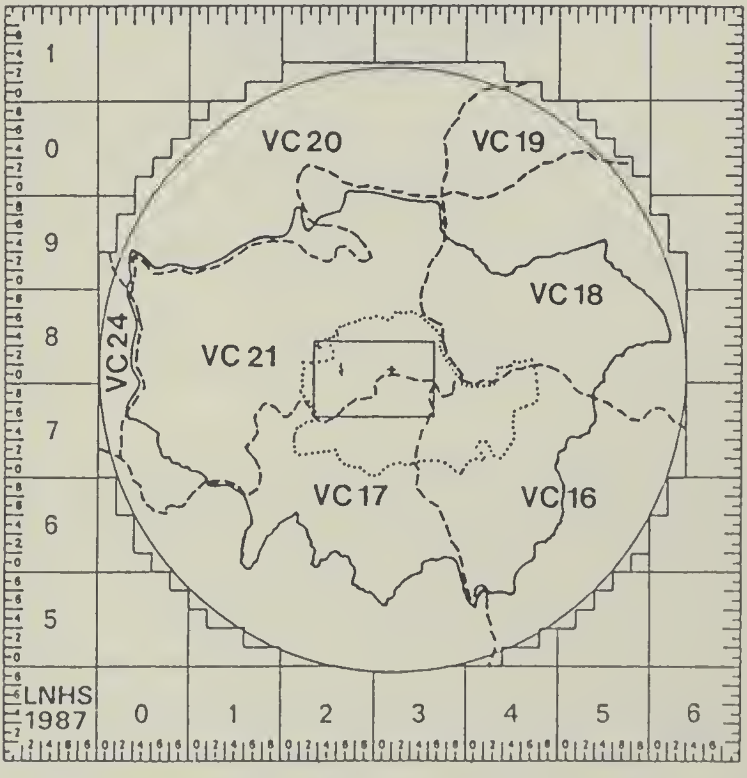


FIG. 1. The Society's Recording Areas. ······ London County Council area, ——— Greater London area, – – – – Watsonian Vice-counties – VC 16 West Kent, VC 17 Surrey, VC 18 South Essex, VC 19 North Essex, VC 20 Herts, VC 21 Middlesex, VC24 Bucks. The central rectangle shows the Society's Inner London area with St Paul's Cathedral marked by a cross.

Figure 1 shows the L.N.H.S. recording areas. Comparing the maps with this figure enables the occurrence of species to be plotted readily within Inner London, the London County Council and Greater London boundaries, and the Watsonian Vice-counties. A transparent overlay is available from the Society's Publications Sales Secretary.

1. REPTILES (818 records)

Of the four reptiles, the greatest number of 1-km squares with records before 1980 is for the common lizard and the order of record abundance is common lizard>grass snake>slow-worm>adder. For post-1979 records the order is slow-worm>grass snake>common lizard>adder. Common lizard and grass snake records have declined and this is considered later in this review.

OPHIDIA

Grass snake *Natrix natrix* (Maps 4 and 5), Figure 2

The grass snake is a species that is more likely to be noticed than other reptiles and this may be due partly to its fecundity and behaviour. Its egg-laying capacity exceeds the life-bearing capacity of the others. Adult grass snakes are large and obvious and may move considerable distances to find suitable warm, humid egg-laying sites and an individual may well visit several 1-km squares. Older records show clusters of up to nine continuous 1-km squares, with newer records up to four continuous 1-km squares. The grass snake has had and still has, a fairly widespread distribution in the recording area, though it has been absent from central London for some time, probably since before records were first documented (Fitter 1949). Grass snakes move and are washed down river systems and they are very occasionally reported along the River Thames as it passes through Inner London. Newer records of grass snake are notably in locations different from the older records. Records show that undisturbed wastelands or industrial sites near to rivers are occupied. Lack of disturbance seems very important. Golf courses, sewage works and gravel-pits are other favoured places. Because of the mobility of grass snakes and lack of detailed studies, the boundaries of populations can be difficult to define. It would seem likely however that in Greater London there are less than 10 places where habitats fulfil the needs of grass snakes and less than half this number have much long-term potential.

As wastelands and less distrubed places are being developed, the future for grass snakes (and snakes in general – see adder) in the recording area as a whole

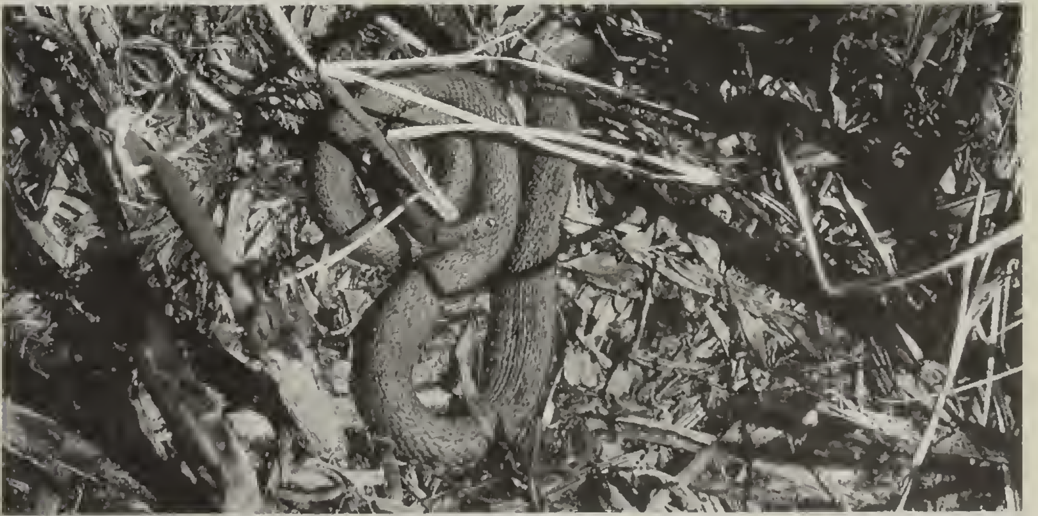


FIG. 2. GRASS SNAKE *Natrix natrix* in undisturbed, natural basking position at a wetland site in Hillingdon, Middlesex. *Photo: Tom Langton*

looks quite bleak. It seems hard to be optimistic unless considerable resources were to be put into safeguarding existing sites and a few new ones.

ADDER OR NORTHERN VIPER *Vipera berus* (Maps 6 and 7)

Records of this small, venomous snake have had a distinctly local distribution since records began (Yalden 1967). Like the grass snake, it may have been commoner in pre-recording times. Adders are commoner on Surrey and Kent heathlands and grasslands and are absent from Hertfordshire. They seem to have a widespread but local distribution in Essex and East Anglia (Langton 1989*a*). These wider trends are not demonstrated by the maps due to the relatively small size of the L.N.H.S. recording area. The decline of adders appears to have been equally severe in London both on north and south sides of the River Thames. The trend of greater adder abundance in south London is further confirmed by reports from the 1920s of adder collectors travelling from east London to southwest London to capture adders (French 1983).

The adder has continued its decline this century (Stubbs 1920, Malenoir 1963) and is now all but extinct in Greater London, with populations hanging on in two areas, both of which have been re-stocked from adder colonies outside London. A few other records from outside the Greater London boundary are from sites in north Kent with a few snakes remaining, often with uncertain prospects. This species could well become extinct within the L.N.H.S. recording areas by the end of the century unless substantial resources are put into its conservation.

LACERTILIA

COMMON LIZARD *Lacerta vivipara* (Maps 8 and 9), Frontispiece

Legged lizards are not always as noticeable as snakes. They are equally timid but smaller and less obvious when escaping; often just a short rustle is heard. Pre-1980 records indicate common lizards to be widespread and locally abundant, in one case with 28 continuous 1-km squares in the well-recorded Surrey part of the L.N.H.S. recording area.

As with snakes, past records indicate lower numbers of records from urban London. This is consistent with lizards' vulnerability to urban spread and the introduction of predators, such as rats and cats. More recent records are from a diverse range of sources. They suggest a widespread distribution with fewer continuous 1-km squares. Lizards are less mobile than snakes and it is perhaps surprising to see so many new 1-km records. Several are updates on sites previously recorded while others are from sites that are likely to have existed for many years. One cluster of six 1-km square records is the result of my recent survey of railway embankments and disused sidings on six miles of line leaving Paddington Station. It seems highly likely that lack of disturbance has made railway embankments of critical importance to the survival of common lizards and other reptiles in much of the recording area. Many branch lines of railways however, have been closed and have become overgrown, reducing the use by reptiles. It is hard to determine whether the common lizard has really seen a crash in its previous southwest and southeast strongholds. Local knowledge of these two areas suggests that there have been considerable declines.

SLOW-WORM *Anguis fragilis* (Maps 10 and 11), Figure 3

The most secretive of the reptiles, slow-worms are difficult to see basking and are usually found underneath discarded debris. the legless slow-worm has a home range measured in tens or low hundred of metres, not the hundred or low thousands of snakes.

The pre-1980 slow-worm distribution pattern is widespread and in its strongholds, appears, like the common lizard to be locally abundant. Sharing similar habitats to common lizards this is not necessarily surprising though I have noted that common lizard sites do not always have slow-worm present on them and *vice-versa,* in fact, there are few sites with records of both species. This probably demonstrates the variable rates and effects of decline, fragmentation and recolonization in the L.N.H.S. area as the species often co-exist elsewhere in Britain.

Like the common lizard most records are associated with sites on or close to railway lines. There does however appear to be a greater use by slow-worms of larger gardens and slow-worms may be less prone to predation from cats and other predators, perhaps because slow-worms have harder, less easily torn scales.

2. AMPHIBIANS (2,763 records)

Three of the five species are very common animals while the other two are relatively rare and declining. The three widespread anurans have the name 'common' as a prefix to one of their vernacular names.

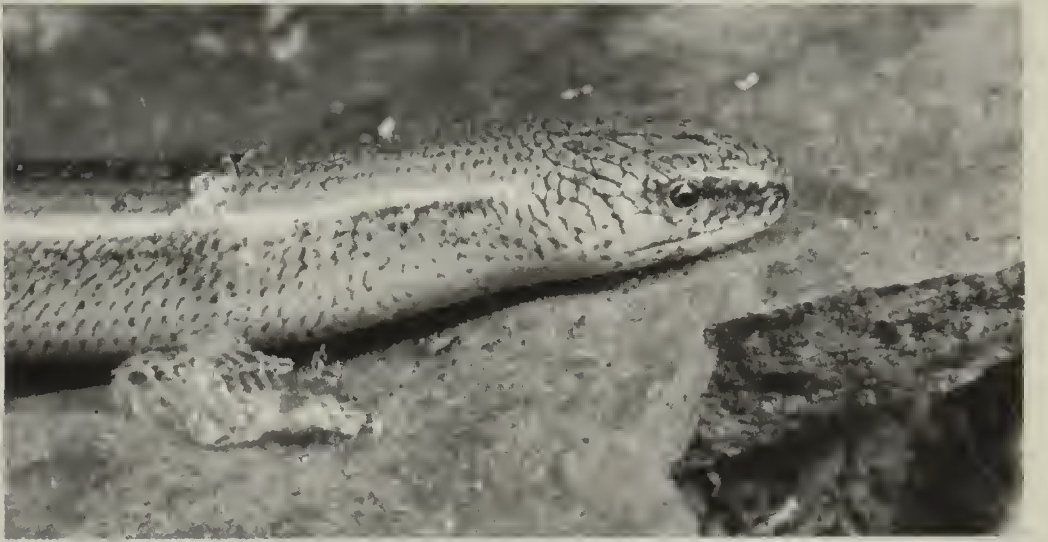


FIG. 3. SLOW-WORM *Anguis fragilis.* A male in process of shedding its old skin. Note typical fragment of sloughed skin. *Photo: Nigel Blake*

The use of amphibians in schools for teaching and the natural curiosity of children and adults has resulted in the moving of adults and spawn into newly dug garden and school ponds and has perpetuated populations. The sale of precast garden ponds and plastic liners over the last 30 years has clearly been a saviour of the common frog, common toad and smooth newt. Water-tables in many areas have been lowered and older farm ponds have declined (Langton 1985).

For records up to and including 1979 the order of abundance is common frog>common toad>smooth newt>crested newt>palmate newt. Since 1980 the order is common frog>smooth newt>common toad>crested newt>palmate newt.

Anura

COMMON TOAD *Bufo bufo* (Maps 12 and 13)

Animals with the word 'common' in their name may not be formally recorded as often as others. Their name may imply that their occurrence is a less noteworthy event. The common toad is widespread and one of the three amphibians that is most frequently recorded in garden ponds. Its self-protecting, distasteful skin and ability to spawn quite deep in ponds, lakes and reservoirs inhabited by fish means that it is able to use still waters unsuitable for other amphibian species. Overall, there does not appear to be much of a negative effect on numbers of records received from the increased urbanisation of London, but it is clear that the habitats being used have changed considerably. Common toads are using garden ponds, but do not always seem to share sites with common frogs. Post-1979 records confirm the widespread status of common toads, with several Inner London locations. Records suggest that common toads, despite being the most frequently recorded amphibian up to the mid-1960s (Yalden 1967), have probably been very under-recorded and that their ability to walk considerable distances to find land habitats and colonise new areas has assisted their spread. There do not seem to be many of the huge breeding aggregations of thousands of toads reported in more rual areas in England, but I have seen hundreds of breeding pairs around ponds in Richmond Park and Epping Forest.

COMMON FROG *Rana temporaria* (Maps 14 and 15), Frontispiece
Common frogs are the only species for which distribution and status have previously been considered in any detail (Burton 1976). It would seem likely that the common frog has increased its distribution since the 1970s although the current new higher level of recording may be a factor. I obtained two hundred records of frogs and frog-spawn in London's garden ponds in 1986 by a publicised 'frogline'; a frog-spawn advisory service, carried out by the Fauna and Flora Preservation Society and part-funded by the London Wildlife Trust. In that survey, many garden pond owners who install ponds for fish or as an ornamental feature reported new common frog colonies starting up. The distribution map reflects an emphasis of survey work within the Greater London area. There may be many times the density of common frogs in urban parts of the L.N.H.S. recording area compared with more rural areas. In some parts of London there are 30 and 40 or so continuous 1-km squares with common frog records and a look at the record cards show there may be more than 10 records in each 1-km square. In much of urban London you are probably never more than tens of metres from the nearest common frog, making it one of the commonest terrestrial vertebrates and possibly (see smooth newt) numerically one of the most abundant.

The common frog was believed to be in decline in the 1960s (Yalden 1965). Burton's (1976) anecdotal survey on its possible decline may either have been the result of that survey being too early this century to record the use of garden ponds by common frogs, or because many of the larger, well-known frog colonies had been lost this century (Burton pers. comm.) giving rise for concern. Common frog habitat loss from destruction and pollution of ponds was reported in that survey as the most frequent reasons for frog decline, and this probably reflects the loss of larger, older breeding sites this century (Stubbs 1920) in areas that have since become more urbanised. From the records it is difficult to ascertain details of numbers, but it is likely that some of the colonies recorded earlier this century numbered thousands of pairs. At the turn of the century up to half of farmland was pasture and hay-meadows, and almost all had ponds. This was particularly true around London where there was a huge demand for hay and milk (Burton pers. comm.).

Urodela

SMOOTH NEWT *Triturus vulgaris* (Maps 16 and 17)
There are relatively few pre-1980 records for the smooth or common newt and, although widespread, a high degree of under-recording is likely. Small garden ponds can hold hundreds of adult smooth newts and this is almost certainly the most numerically abundant of all herpetofauna and one of the commonest land vertebrates in the London Area. The records post-1979 reflect the distribution of London's larger ponds most of which were torch-surveyed in 1980-1984, during searches for crested newts. Most of the records are within the Greater London Survey area. Other records are largely from garden ponds and like the

common frog, increases in this species' distribution over the last 20 years are suspected, with up to 30 continuous 1-km square records.

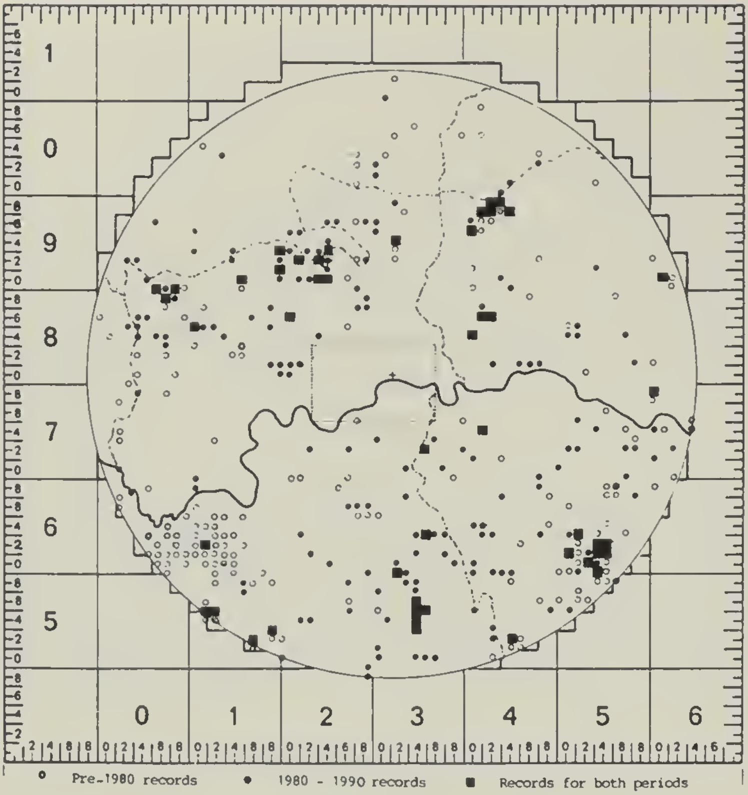
CRESTED NEWT *Triturus cristatus* (Maps 18 and 19)
Otherwise called the great crested newt or warty newt, I prefer to use the simplified name crested newt. This species has been the subject of some intensive surveys since 1980 to determine its status. This is the main reason why the number of crested newt records has increased. There is a widespread but localised distribution pattern supporting the previously described 'sparse and scattered' distribution (Yalden 1967). It should be noted that the outer part of the recording area is relatively under-recorded. One of the more interesting finds from the London Pond Survey (Langton 1985) was that the 71 crested newt ponds located consisted of continuous clusters of up to six ponds, close enough for newts to interchange between ponds and in some cases to be the same population (and 1-km square record). Only 25 (35%) of crested newt ponds were single-pond colonies. A number of records are from garden pond introductions that have not survived or are likely not to persist for very long. Crested newts do not appear to thrive in most garden ponds unless heavily 'gardened' and are likely to be the amphibian species that has most declined in the recording area in recent decades. A lot of information has been gathered on the crested newts in London, and this is to be published separately.

PALMATE NEWT *Triturus helveticus* (Maps 20 and 21)
One problem with this species is that it is hard for the untrained observer to distinguish them from smooth newts except during the breeding season. Even then, distinguishing females is difficult without catching them for close examination. There are no doubt a few smooth newt records that are in fact misidentified palmate newts and the species is also likely, to some extent, to be under represented due to under-recording. This situation has been demonstrated by a survey for all amphibians in southeast London by Keith Corbett from 1978-1982. In a survey of all non-garden ponds in an area of southeast London he found palmate newts to be present in lower numbers, with a tendency for the species to be harder to find during torch surveys than other newts. Yalden (1965) thought that cold tolerance might be a factor in under-recording of palmate newts, and this subject may warrant further enquiry. My survey work for newts in 1983-4 found that the species is less common outside southeast London, and possibly approaching crested newts in terms of its scarcity in the L.N.H.S. area. I have reported that it is twice as common as crested newts in Greater London (Langton 1985), though rechecking the definite reliable records for the species suggests that while likely, this is yet to be demonstrated. A London-wide appeal for palmate newt records is hereby launched.

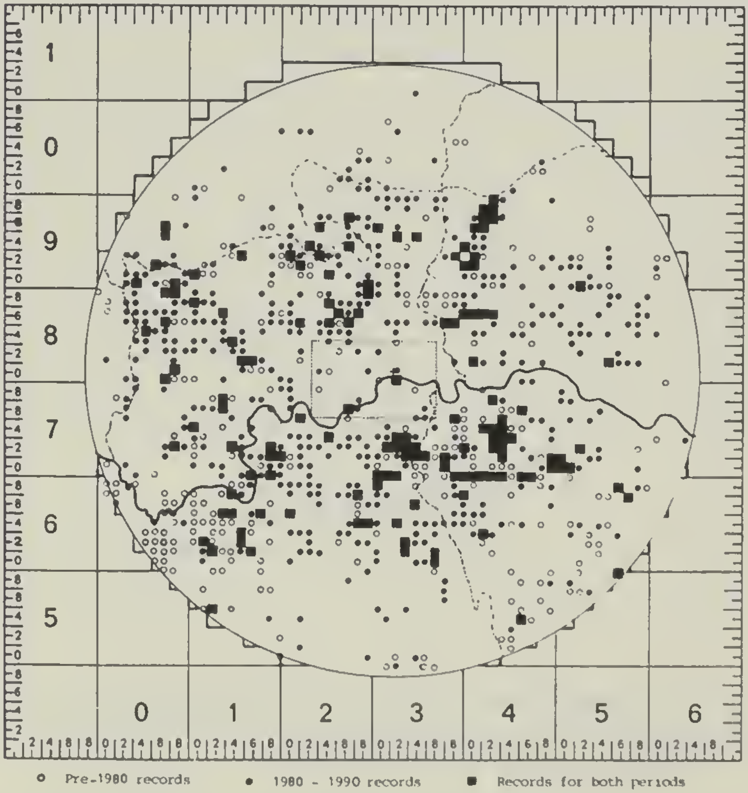
Distribution Maps

Map 1 shows the density of houses with gardens within the London Area, whilst Maps 2 and 3 show the total records for reptiles and amphibians respectively. Maps 4 to 21 show the distribution of the nine native species currently recorded in the London Area.

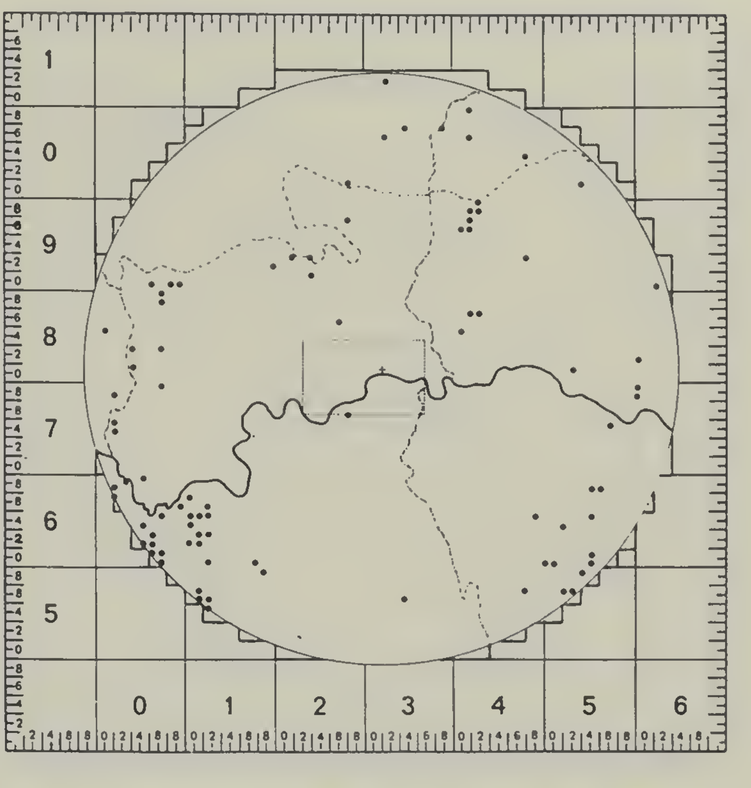
[Editor's Note: As the records are plotted on 1-km squares (monads), as opposed to the more usual 2-km squares (tetrads), the grid-lines have, with the exception of Map 1, been omitted due to difficulties arising during production].



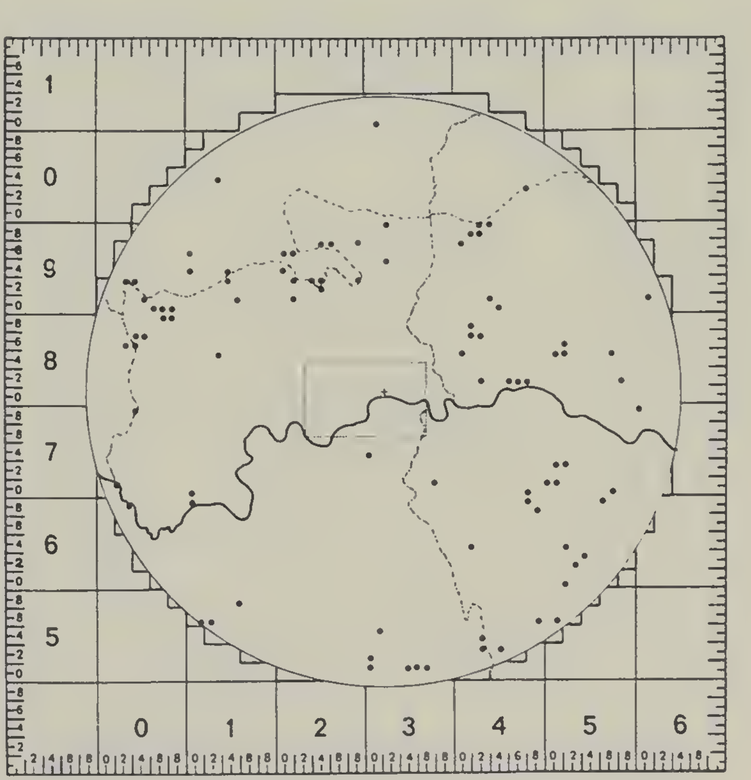
Map 2. Distribution of all 1-km squares with at least one reptile record included in this review.



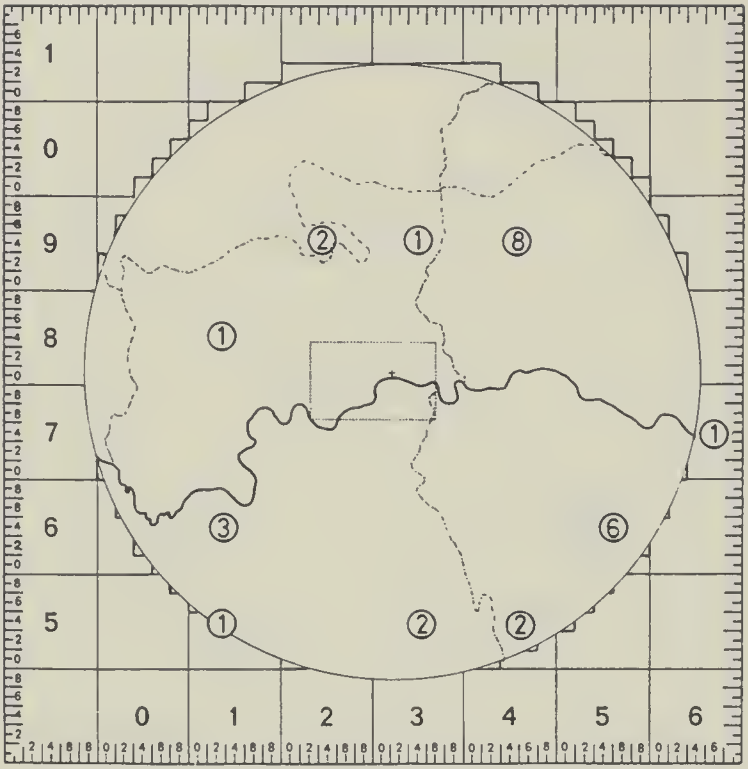
Map 3. Distribution of all 1-km squares with at least one amphibian record included in this review.



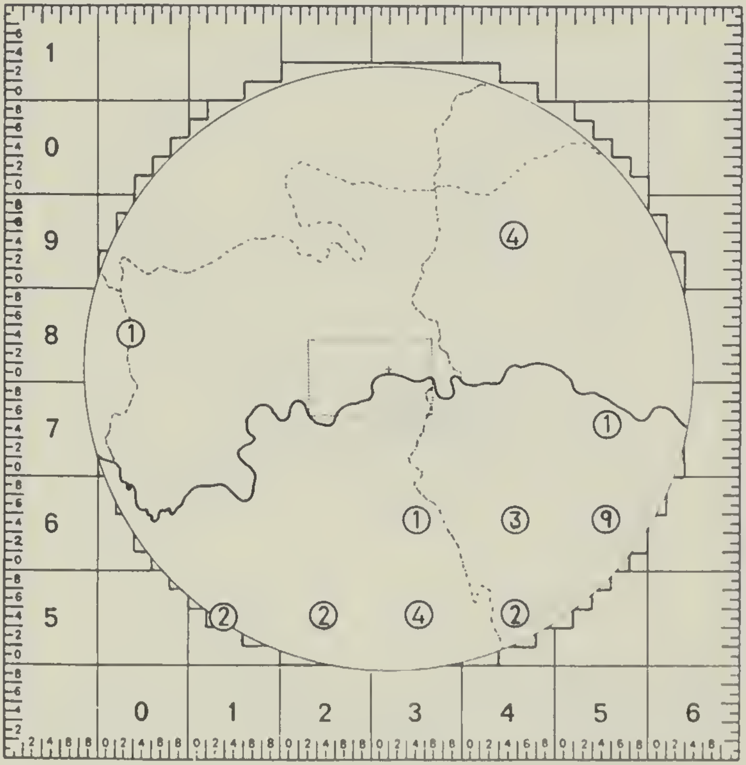
Map 4. Grass snake *Natrix natrix* records in 1-km squares, pre-1980.



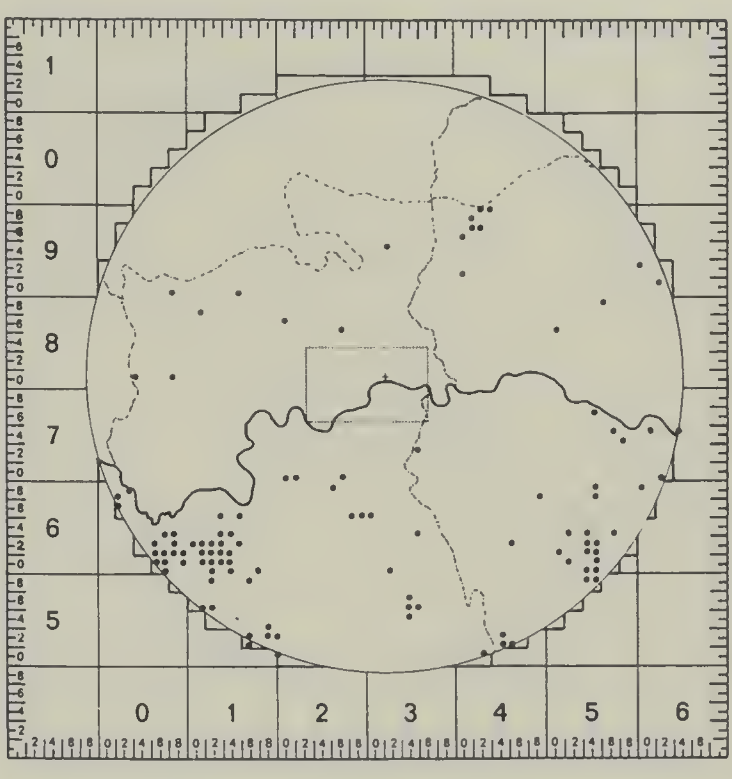
Map 5. Grass snake *Natrix natrix* records in 1-km squares, 1980-1990.



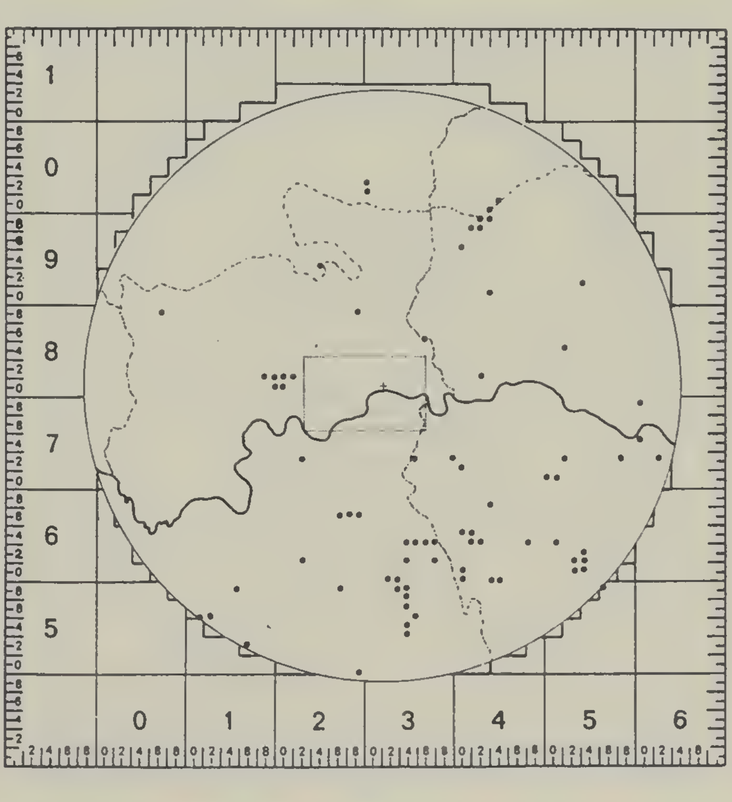
Map 6. Adder *Vipera berus* records, pre-1980. Number of 1-km squares with records in each 10 × 10-km square. The number is placed at the centre of each 10-km square.



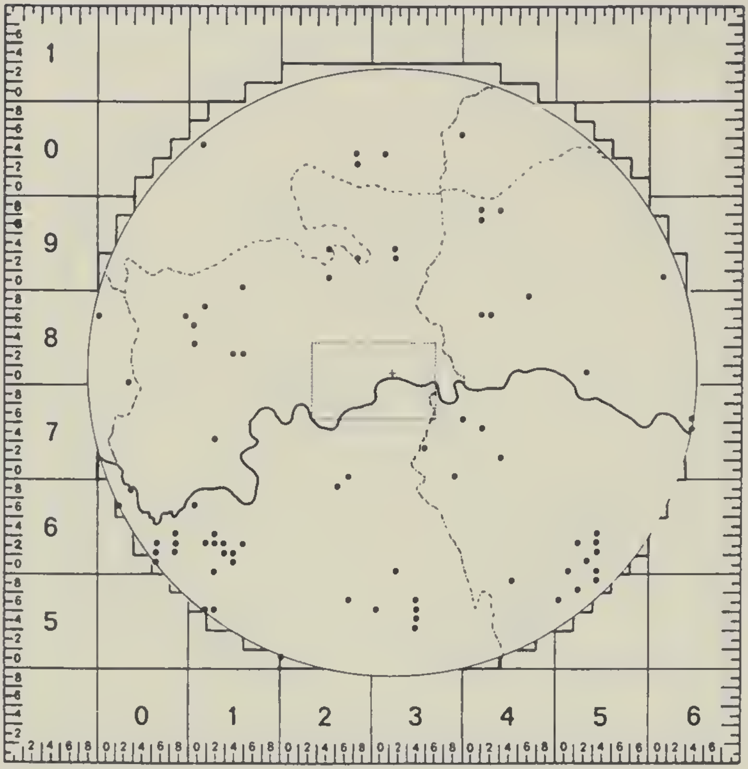
Map 7. Adder *Vipera berus* records, 1980-1990. Number of 1-km squares with records in each 10 × 10-km square. The number is placed at the centre of each 10-km square.



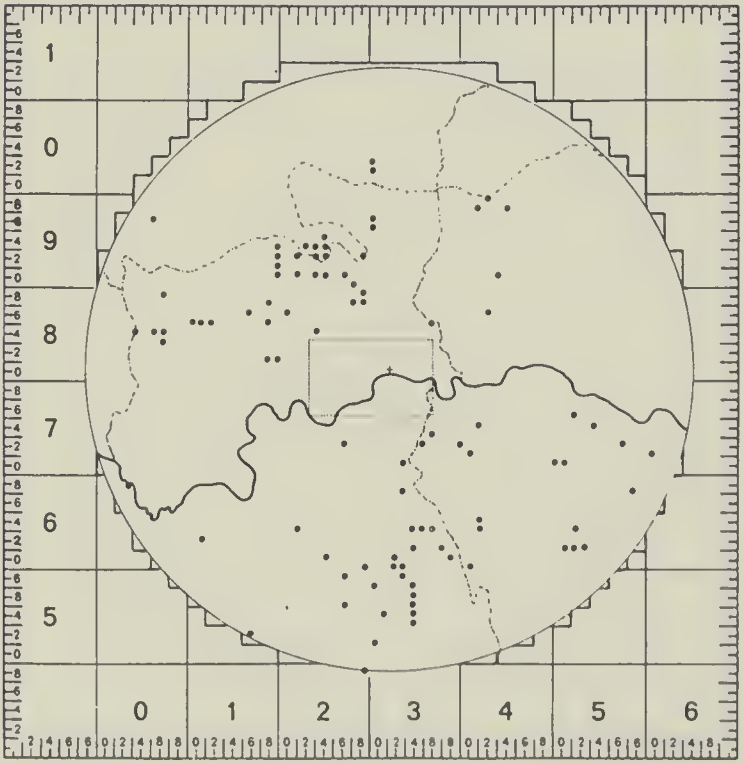
MAP 8. COMMON LIZARD *Lacerta vivipara* records in 1-km squares, pre-1980.



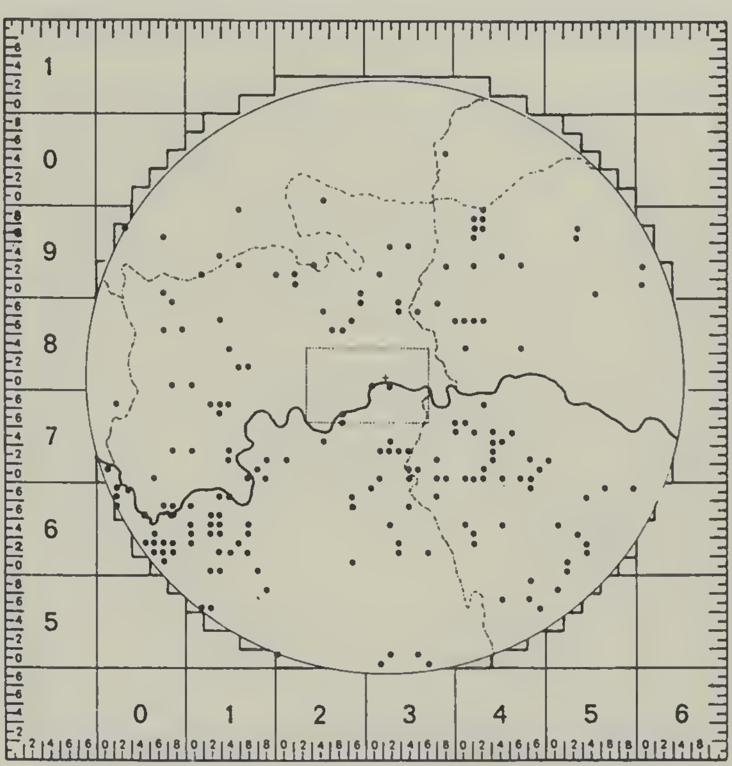
MAP 9. COMMON LIZARD *Lacerta vivipara* records in 1-km squares, 1980-1990.



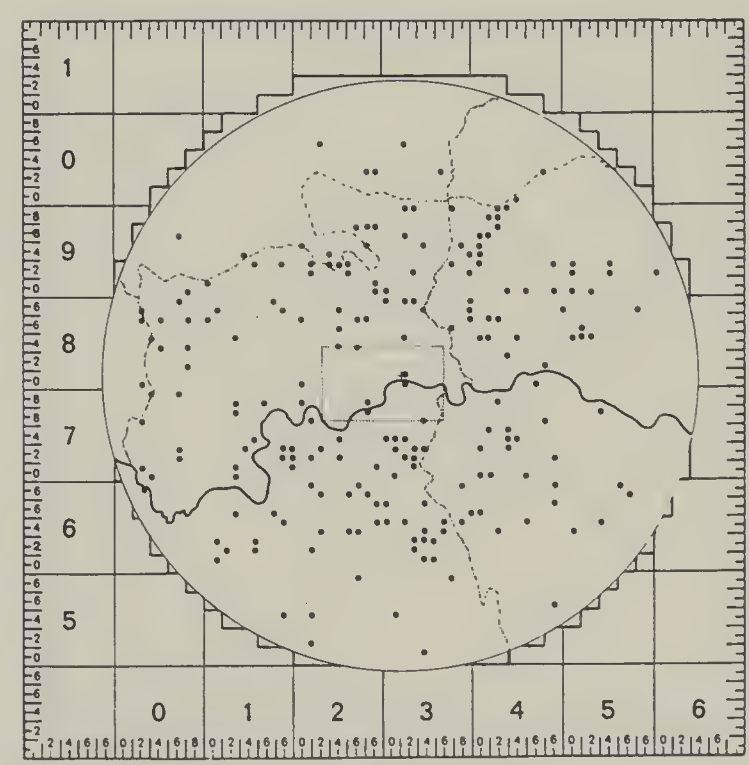
Map 10. Slow-worm *Anguis fragilis* records in 1-km squares, pre-1980.



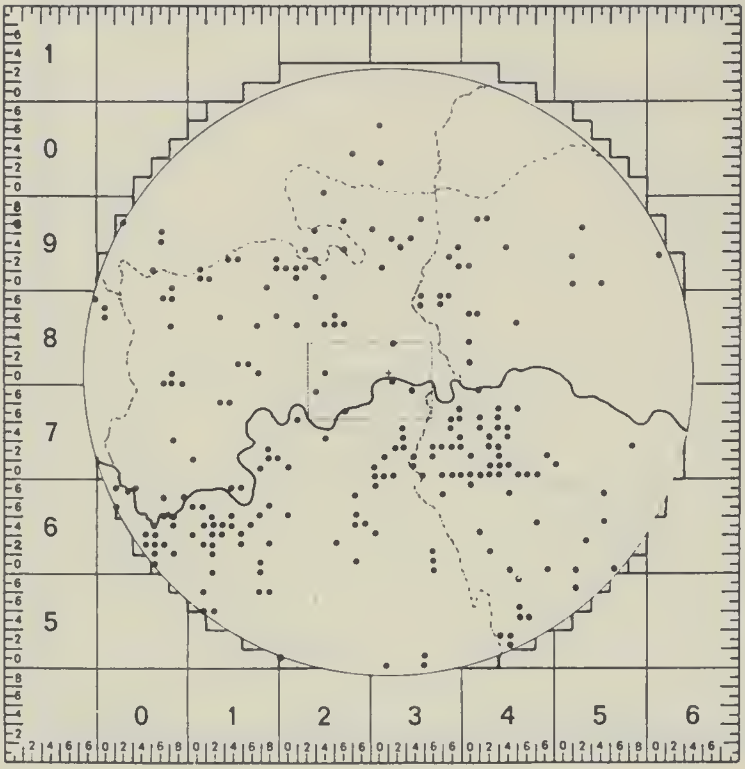
Map 11. Slow-worm *Anguis fragilis* records in 1-km squares, 1980-1990.



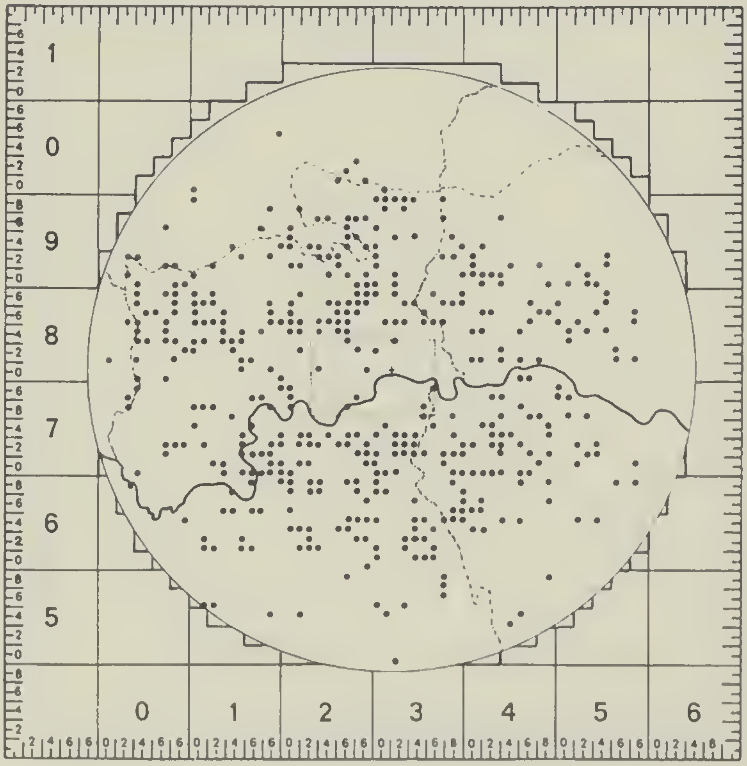
Map 12. Common toad *Bufo bufo* records in 1-km squares, pre-1980.



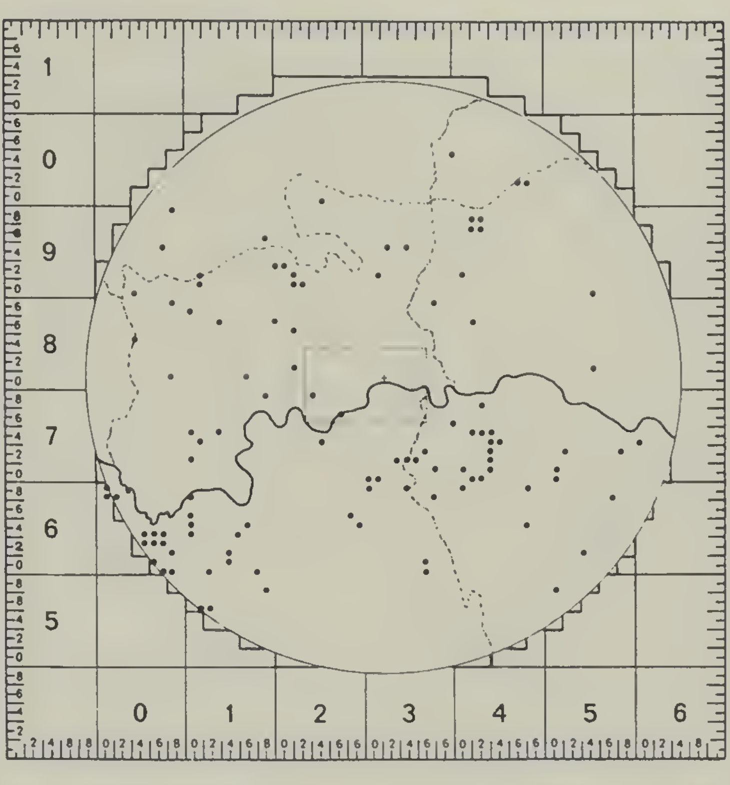
Map 13. Common toad *Bufo bufo* records in 1-km squares, 1980-1990.



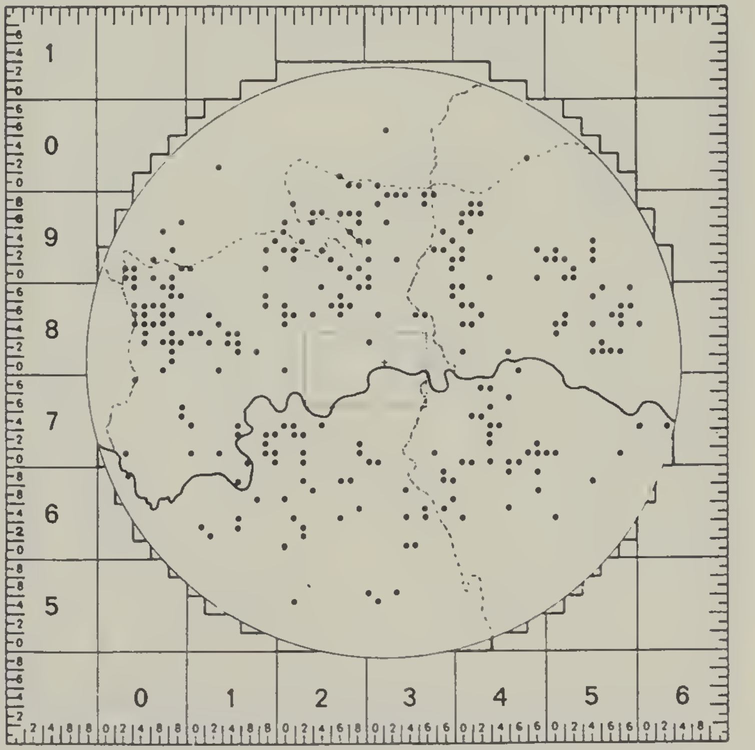
Map 14. Common frog *Rana temporaria* records in 1-km squares, pre-1980.



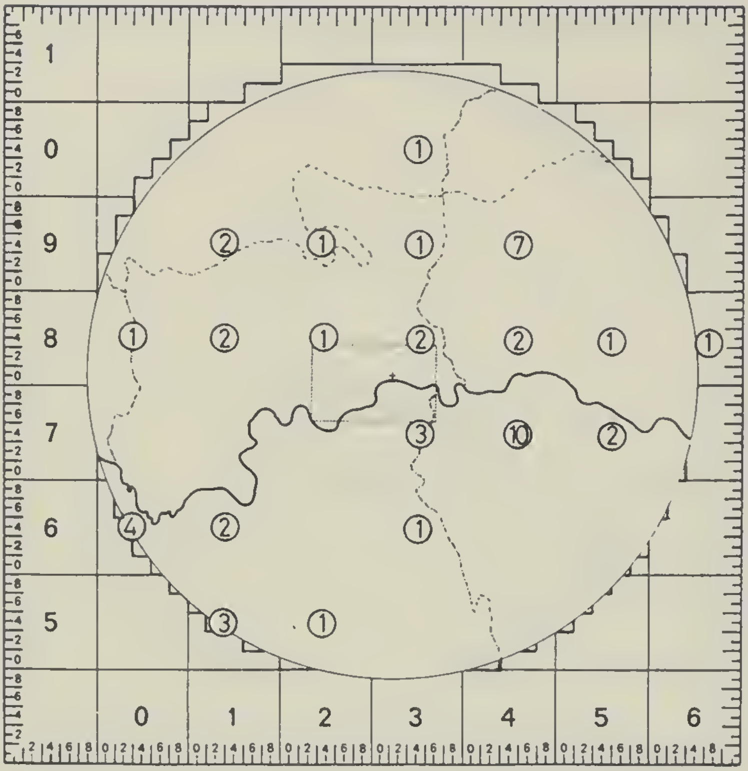
Map 15. Common frog *Rana temporaria* records in 1-km squares, 1980-1990.



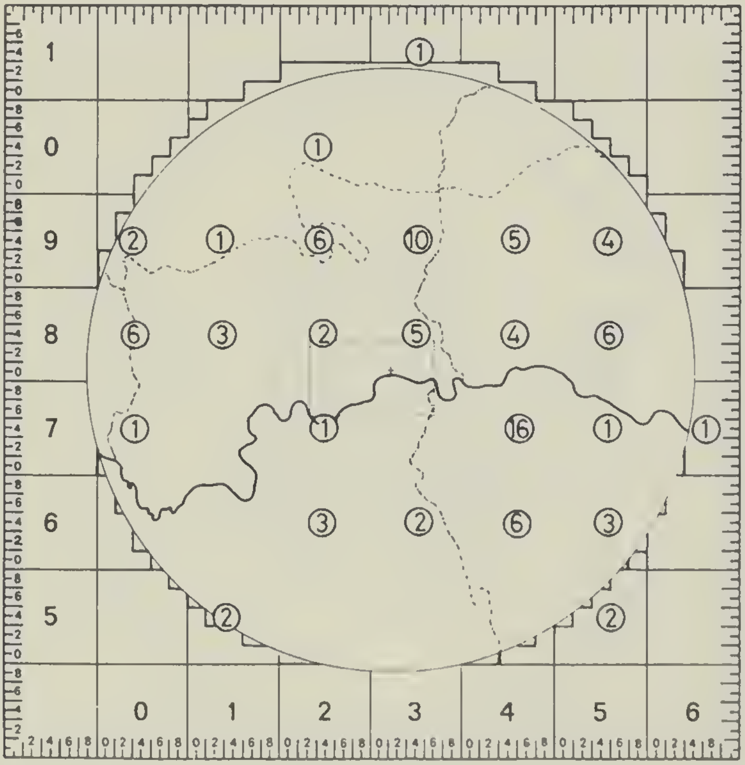
Map 16. Smooth newt *Triturus vulgaris* records in 1-km squares, pre-1980.



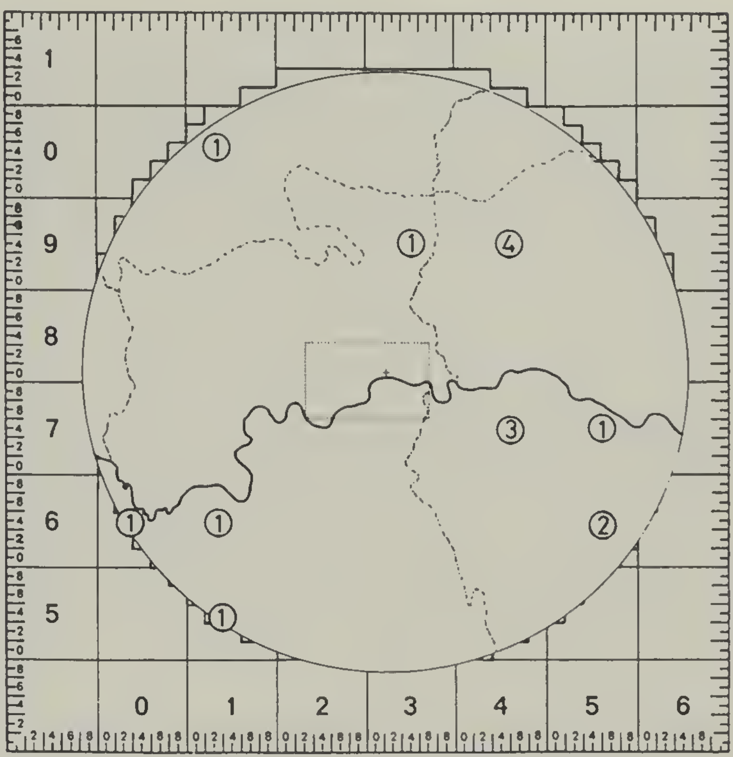
Map 17. Smooth newt *Triturus vulgaris* records in 1-km squares, 1980-1990.



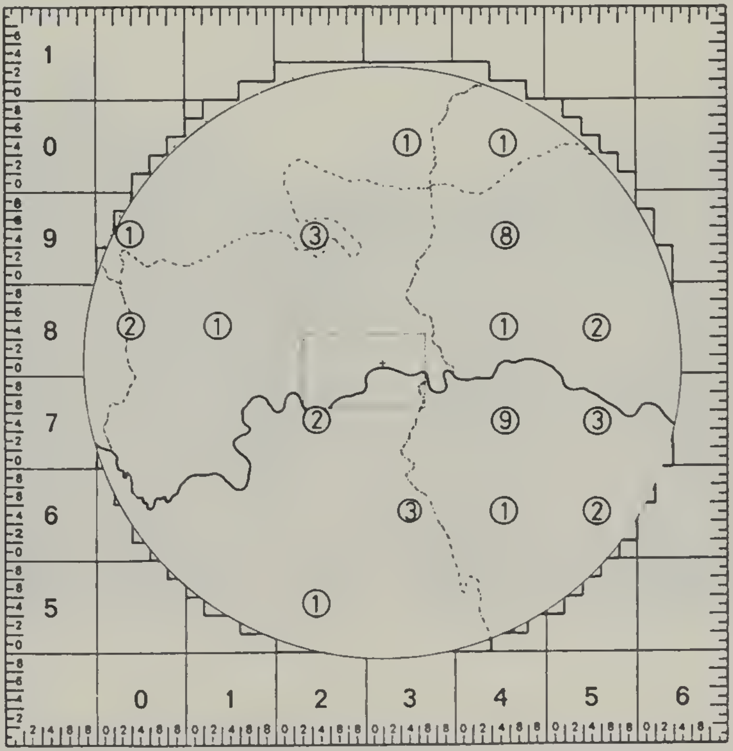
Map 18. Crested newt *Triturus cristatus* records, pre-1980. Number of 1-km squares with records in each 10 × 10-km square. The number is placed at the centre of each 10-km square.



Map 19. Crested newt *Triturus cristatus* records, 1980-1990. Number of 1-km squares with records in each 10 × 10-km square. The number is placed at the centre of each 10-km square.



MAP 20. PALMATE NEWT *Triturus helveticus* records, pre-1980. Number of 1-km squares with records in each 10 × 10-km square. The number is placed at the centre of each 10-km square.



MAP 21. PALMATE NEWT *Triturus helveticus* records, 1980-1990. Number of 1-km squares with records in each 10 × 10-km square. The number is placed at the centre of each 10-km square.

Introduced Species

The records of exotic herpetofauna in London originate from releases or escapes (Yalden 1965). Edible frogs do not seem to have established to any degree (Yalden 1965). The L.N.H.S. used to organise field trips to hear edible frogs on Hampstead Heath in the 1950s-60s and this is an example of one short-lived colony. Other green frogs may have done better and more long-term monitoring would be useful. The distribution of records and status of introduced species will be published separately.

Conservation

Conservation of herpetofauna within the L.N.H.S. recording area is beyond the scope of this review. However it does seem appropriate to consider some of the implications of the apparent trends indicated by records, past and present literature, and the letters and personal observations of people living in London. Loss of herpetofauna from London is not a new event, with the sand lizard *Lacerta agilis*, and natterjack toad *Bufo calamita* and probably the smooth snake *Coronella austriaca*, having declined and becoming extinct in the L.N.H.S. recording area this century. The risk of losing further species is very real and will be hard to stop without concerted effort from those concerned with wildlife conservation.

As might be anticipated, the snakes have suffered most from the growth in spread of London's roads and buildings, with the adder moving towards extinction in Greater London. Lizards may have benefited from the grassy embankments constructed for railways (Figure 4). Loss of wasteland and change in quality of larger grassland sites probably mean that railway embankments now hold a high proportion of London's lizards. Road and railway embankments offer potential for future colonization by lizards, particularly if landscaped and managed in an appropriate way. For reptiles in general, it is clear that there is need for a concerted effort if decline is not to continue.

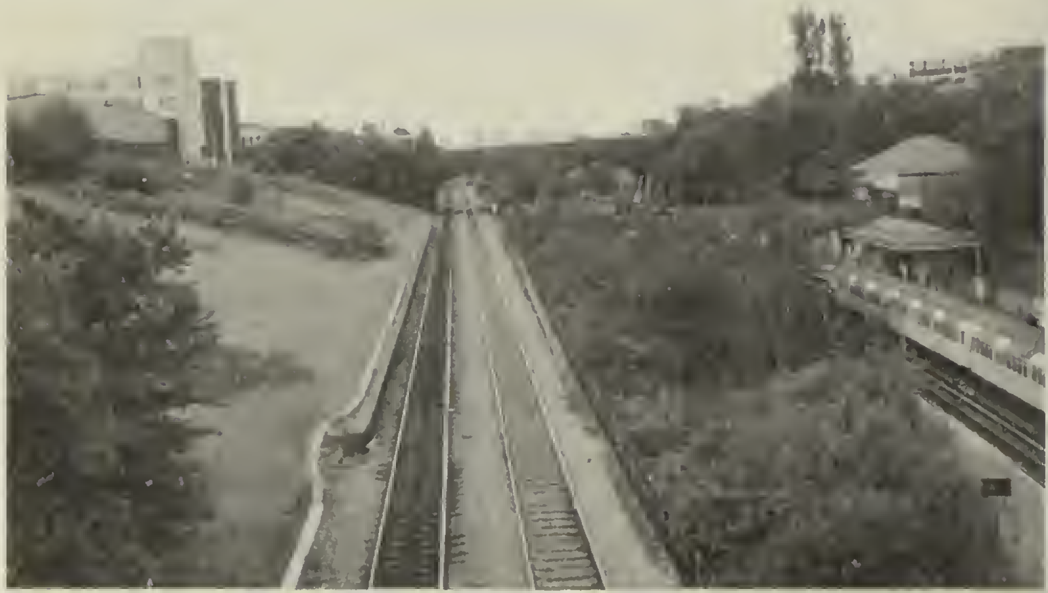


FIG. 4. South-facing railway cutting (to left of tracks), inhabited by both slow-worms and common lizards. *Photo: Tom Langton*

Conservation objectives might include the identification of every remaining population by conducting surveys and then preparing site registers showing the distribution and key areas within each site. This would then assist voluntary conservation organisations, local authorities and statutory bodies to safeguard and manage sites properly.

With amphibians, pond conservation holds a key to their safeguard. As important is the protection of areas of semi-natural habitats around ponds that form the terrestrial habitats of amphibians. In addition to encouraging garden ponds to be managed for wildlife, the non-garden ponds of the L.N.H.S. area should be catalogued, using as a basis the pond surveys conducted in Greater London and Hertfordshire. Some further survey work should be carried out, particularly in Outer London. Site Registers for all sites with four or five species of Amphibia and all crested and palmate newt sites are needed. The largest breeding assemblages of the commoner species should also be considered a high priority. A national pond preservation system will hopefully be introduced in the 1990s to provide widespread protection for ponds in future years. The identification of sites included in local authorities' structure plans is a further measure that is needed.

With both reptiles and amphibians, habitat management is becoming increasingly important. As lack of disturbance of sites is important to reptiles, excluding or reducing human access to sites will become vital, yet difficult politically on public land in urban areas.

Threats to herpetofauna, other than damage and loss of habitat and breeding sites (Figure 5), include direct human persecution: killing, trade and private collection, excessive predation from cats and rats, mortality due to motorcars, and being trapped in road drains, poisoning from use and leaks of chemicals, and fires.

The construction of ponds for wildlife is one opportunity that is being taken up and will hopefully continue to be encouraged (Figure 6). Restoration of a pond that is completely silted up is an often-overlooked and cost-effective option (Figure 7).

Ultimately, protection of the six rarer species of herpetofauna that do not seem to benefit from breeding in garden ponds will rest on species protection that invokes measures to retain and enhance their habitats. This is because of the high land values in London's urban setting and the requirements of the growing human population. Very substantial public and private funds will initially be needed to retain and manage the largely fragmented islands of habitats and this will require both strategic nature conservation planning and integration with the needs of other species.

Acknowledgements

A list of those who have made records of herpetofauna in London is given below. Thanks are due to members, officers and staff of several organisations who have helped supply records to county-based record centres. Local natural history/conservation group records were supplied by interested individuals following appeals for records by letter and in newsletters. Included are Buckinghamshire County Museum, Maidstone Borough Council (Kent), Hertfordshire Environmental Records Centre, Passmore Edwards Museum (Essex), Surrey Amphibian and Reptile Group, Herts and Middlesex Reptile and Amphibian Group, Ruislip and District Natural History Society, Thames Valley Natural History Society, London Wildlife Trust, London Natural History Society and Orpington Field Club.

Particular thanks go to Keith Corbett who taught me field techniques for the surveying of amphibians during his 'blanket' pond survey in southeast London in 1978-82. The majority of recent amphibian records for southeast London come from his thorough search of much of this area. As a result of Keith Corbett's findings, the author conducted a survey of crested newts in 1984, funded by the Greater London Council Ecology Unit by grant aid to the Fauna and Flora Preservation Society. John A. Burton/F.F.P.S. administered this work and members of the G.L.C.E.U.: David Dawson and Meg Game assisted. Other smaller scale surveys for herpetofauna have been carried out, including those by Martin Catt, John Church, John Gaughan, Monica Green, Howard Inns, Kevin Morgan, Alan and Christopher Sauvarin, Graham Walters, Barry Watson and Bill Whitaker.

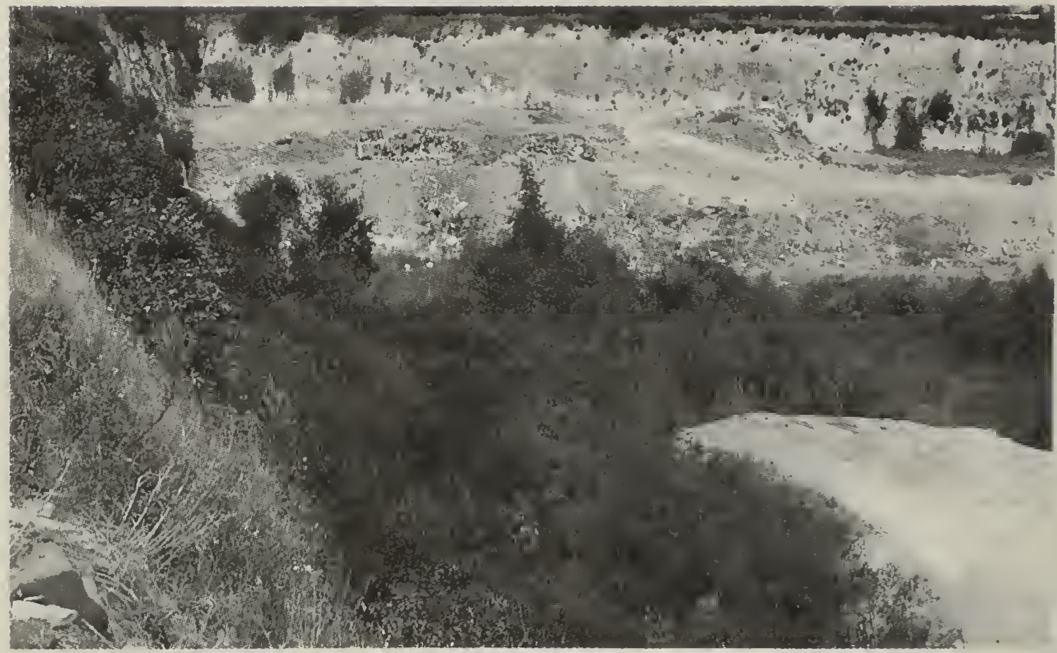


FIG. 5. Bamber Pit, Swanscombe, Kent. A deep chalk-pit with flooded areas surrounded by willow scrub. This held the largest recorded population of crested newts in the L.N.H.S. recording area. The site was infilled with domestic refuse throughout the 1980s as planning permission to do this pre-dated the legal protection of this species.
Photo: Tom Langton

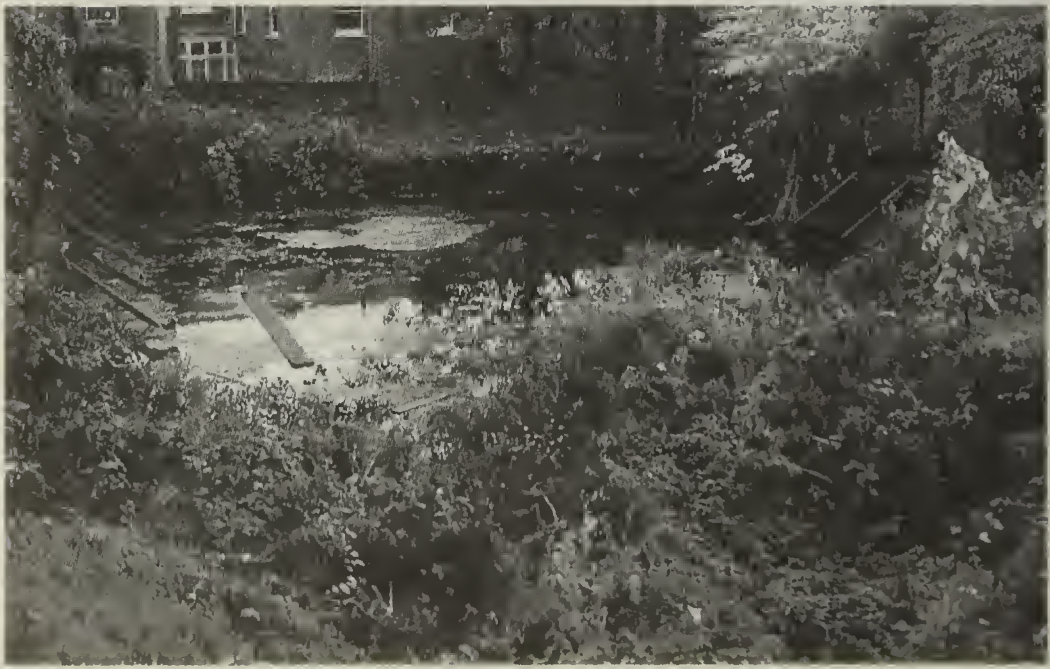


FIG. 6. An urban amphibian pond in the London Borough of Camden – the flooded concrete base of a building. Common frogs and smooth newts bred here until the site was infilled for development.
Photo: Tom Langton

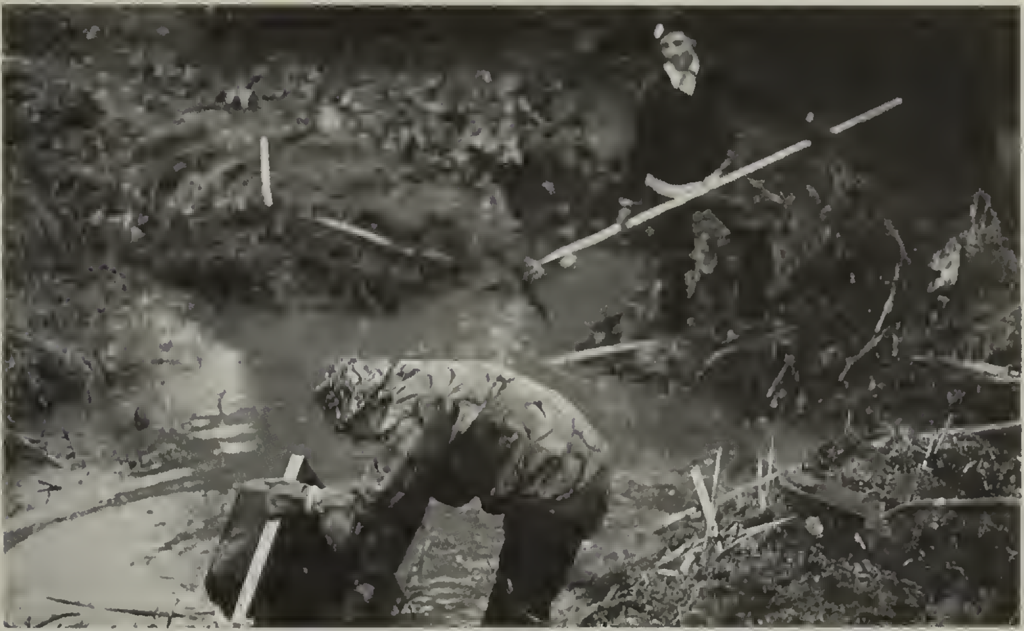


FIG. 7. Small agricultural ponds and neglected, larger garden ponds can often be restored with the labour of a small working-party in a day or two. The renovation of completely derelict old ponds is a high conservation priority. *Photo: Tom Langton*

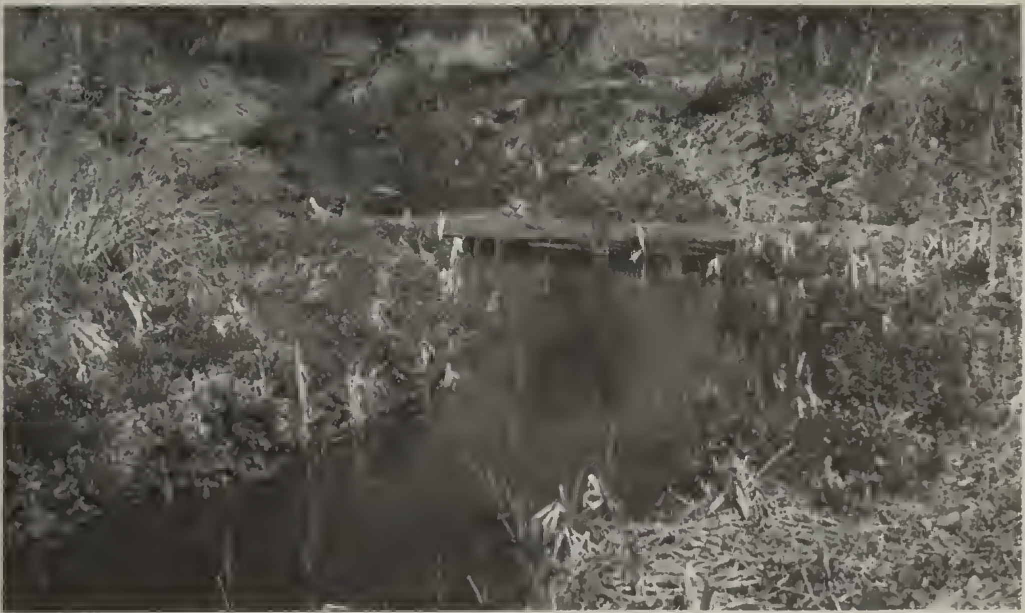


FIG. 8. Undisturbed river and ditch banks are important habitats for grass snakes. They are becoming increasingly scarce in the London Area. *Photo: Tom Langton*

Collation of records and mapping for this review was made possible by grant aid from Herpetofauna Conservation International Ltd.: Ian Dunmore assisted with record collation and mapping. The slow-worm, common lizard and common frog photographs in this review were taken by Nigel Blake. Others that assisted are: Catherine Beckett, Peter King, Eric Philp, Colin Plant, Peter Tinning and Derek Yalden. I am grateful to Keith Corbett and John A. Burton for comments on an earlier manuscript.

The following is a list of names from whom records have been received since 1979, and some of those recording before that date to whom definite records can be attributed. Care has been taken to transcribe names accurately, but in some cases insufficient information was available, *e.g.* title and surname only. In general, a surname and the first initial have been made available. Errors and omissions are the responsibility of the author.

Mr Acken, J. Alden, M. Allan, V. Allen, E. Anderson, P. Andrew, Mr Appel, A. Archer, W. Armstrong, C. B. Ashby, Ms Atkin, W. Atkins, Mrs A. Bailey, C. Baker, L. Baker, Mr & Mrs Baker, Mr & Mrs Baldwin, L. Balsover, B. Banks, M. Banks, W. Barker, Mr Barton, Mr Batier, I. R. Beames, L. Beames, C. L. Beckett, E. Bedfont, Mrs Bell Foden, G. Beven, Mrs G. Birch, Mrs Blackton, V. Blade, Mr Blinson, C. Boase, N. Bowman, Mr & Mrs Boyle, Mrs Boyn-Sowtt, Mr Brasted, Mr Bray, D. Broadrib, T. Brockington, S. J. Brooks, C. Brown, E. Brown, Ms Brown, R. Brown, S. Buckner, Mr Bulter, J. A. Burton, N. Burton, Mrs Caiards, J. Carey, G. Carney, J. Carr, J. Carrick, M. Catt, R. Cauf, G. Cavney, Prof. Cawston, Mrs J. Cecil, P. J. Chaddcr, D. Chapple, Mrs Chase, M. Chipperfield, Mrs Chitty, Mrs Christie, J. Church, M. Clark, A. Clerk, P. Clifforth, C. Cobley, J. Colmans, R. Conner, A. Cooper, G. Cooper, J. Cooper, K. F. Corbett, R. Cox, R. F. Cox, P. Creasey, Mrs Crisp, Lady Cronham, Mrs Crooks, Mr Curling, Mrs Curtis, P. Davies, R. Davis, Mrs Davis, P. Davy, Mrs Daws, S. Dean, J. Dewar, R. Dewey, D. Dey, Miss Dillon-Gibbons, B. Ditten, W. Dolling, Mr Doust, Ms Doyle, P. Driscoll, A. Duff, D. Dunn, Mr Eastwood, Mrs Eaton, Mrs Edwards, P. Edwards, Mrs Elder, Mr Elford, Mr Elliott, Miss M. England, Mrs Evans, H. Eve, L. & R. Eversfield, Mrs Farrant, Mrs Feasey, Mr Fell, I. Ferguson, D. Fiford, Mrs Fisher, R. S. R. Fitter, C. Fitzsimmons, E. Flint, Mrs Flock, Mrs Flookes, D. Floyd, T. Fooks, Mr Forcett, S. Ford, D. Frazer, Mr French, S. French, Mrs E. Frill, Mr Fuzzey, J. Gaughan, Mr Geddes, C. George, Mrs Gibson, Mr Giles, A. Goldsmith, Mrs Goldstone, D. Grant, G. Grant, Mrs Gray, Mrs Greatiey, B. Green, C. Green, M. Green, V. A. Green, D. Griffith, P. Grub, R. Guley, G. Gush, J. Halliday, M. Halpin, H. Hampton, J. Hampton, C. Harding, Mr Hardy, T. Hare, J. E. Harvey, Mrs M. Hawkes, A. Hayward, J. Hazel, A. Hebgin, Mrs Henwood, C. Herbert, J. W. Heward, S. Hewish, K. Hill, E. Hillman, Mrs Hills, G. Hillwood, G. Hitchcock, P. C. Holland, R. Holly, A. Holmes, C. Hope, M. Hope, P. Howse, A. Hughes, Ms Hunter, H. Hurford, R. Husband, A. M. Hutson, M. Huxley, B. Ing, H. Inns, O. John, M. Jolly, C. Jones, Mrs Jones, P. Kandon, D. Keeley, K. Kegan, Mrs J. Kellett, M. Kennedy, Ms L. Kennedy, H. Kenward, Mr Keston, R. H. Kettle, R. Killiminster, Mrs Kinaurd, H. King, J. King, P. W. King, Mrs King, P. Kinnear, B. Kneller, R. Knott, C. Kubale, Mrs Langfield, E. Lansdell, J. Latuskie, Mrs Lazenby, C. Lee, Mr Lewell, D. Lewis, Mr Linsey, Mrs Litewsky, F. Lockwood, J. Lynch, G. Lyris, D. Marlborough, H. Marshall, Mrs J. Marshall, K. Martin, D. Massey, Mrs Mettell, H. Matthews, A. Mayles, P. McDonald, Mr McLillop, J. Meek, S. Melville, Mr Mercer, Mrs Merrit, Mr Michain, L. Midgin, C. Miller, W. Minnion, Mrs Monley, Mrs Moore, P. Morden, E. Morris, P. A. Morris, P. A. Moxey, V. Mulford, J. Muncaster, R. Munday, Mr Munns, Mrs E. Murphy, A. F. Musselwhite, Ms P. Mylonar, J. Nelson, Mr O'Flin, Mr Osborne, M. Otter, Mrs Owen, R. Owen, Mr Paine, A. Paine, B. Palmer, R. Palmer, A. Parkyn, A. Parry, R. Parnell, P. Petcham, Mrs Peterken, Mrs J. Philipson, E. G. Philp, B. P. Pickess, C. W. Pierce, Mrs Pierce, J. Pitt, W. Pitt, C. Plant, P. Plowman, Mr Pollard, K. Pope, Mrs D. Poplet, J. Price, Mrs Radley, Mrs Railing, Mrs E. Randall, R. Rarwick, Mrs F. Rawlings, Mr Redding, H. Reed, F. Reeves, D. Regan, J. Regan, Mrs Richards, G. Richardson, Mrs Rigby, R. Rigden, D. Rocel, Mrs Rogers, C. W. Roome, Mrs Rosenberg, J. Rouse, Mr Rowe, D. Ruck, Ruislip & Dist. Museum, P. Rumbol, Mrs Rupert, Mrs Russell, Ms Rust, Dr Sabine, Mrs Saddly, Mr Sargent, A. & C. Sauvarin, S. Schmitt, J. H. Scott, Mrs Scott, Mrs Shepard, Mrs V. Sherradon, L. Small, Mrs Smith, R. Smith, C. Snell, Mr Spain, Mrs Sparks, K. Springett, K. Springfold, S. St Clair, R. Stainno, S. Stevens, M. Stewart, Mrs Stockford, Ms Stockwood, I. Stokes, D. Street, Mrs Stringer, D. Stuart, Mrs Stubbs, Mrs Sturt, Mr Sullivan, Mrs Syer, J. Tatum, V. Taylor, W. G. Taylor, W. G. Teagle, J. F. Teagle, J. Tell, J. Tester, V. Thodon, D. Thomas, M. Thomas, A. S. Thorley, M. Thorn, Mrs Thorne, C. Thraynm, Mrs D. Thuner, B. Tiffen, Mrs Tinnemans, P. & P. Tinning, P. K. Torling, M. Towns, Mrs Townsend, Mrs Trowse, D. Tulett, J. Turner, Mr Twiddle, A. Vaughan, Mrs Vincent, Mr Voisey, H. Vosper, E. Wade, B. Wallbridge, Ms A. Walsh, G. Walters, Mrs A. Warren, R. B. Warren, R. Warwick, B. Watson, A. Weaver, M. Wells, K. White, S. Whitley, B. Whitaker, Mrs Wickmister, Mrs Wilkerson, G. Williams, L. R. Williams, S. A. Williams, A. Wilmot, Mr Wilson, P. Wilson, W. Wilson, Mrs Wittett, Mrs Wood, F. Woollon, F. Wright, J. Wycherley, D. W. Yalden, E. Young.

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Book Reviews

Urban Ecology: Plants and Communities in Urban Habitats. Edited by H. Sukopp and S. Hejný. SPB Academic Publishing, The Hague. 1990. 282 pp. Price not known. ISBN 90 5103 040 1.

The Ecology of Urban Habitats. By O. L. Gilbert. Chapman and Hall, London. 1989. 369 pp. £30. ISBN 0 412 28270 4.

These two books indicate how the study of urban environments fits into the general pattern of academic ecology on the Continent and in Britain.

Urban Ecology is a collection of papers constructed around a number of contributions to the 14th International Botanical Congress in Berlin in 1987, but with numerous updating and review articles, notably Prof. Sukopp's own on 'Urban Ecology and its Application in Europe'. He and other authors can find little to say about scientific work done in Britain, but praise highly the application of ecological principles to the planning of our new towns. The continental popularity of the Braun-Blanquet method of phytosociological description is evident in many of these papers, and a review by L. Mucica of work in Eastern Europe cites perhaps 150 references to publications which are probably excellent descriptive science which never gets applied to habitat management and conservation. A partial exception is the city of Prague, as described by J. Kubíková, where important natural communities incorporated into the boundaries have been identified and protected from building and road development. She describes a reserve of 0.5 hectares 'where plant communities of Euphorbio-Callunetum and Scabioso-Brachypodietum are growing', surrounded by a belt of forest and orchards, which between 1974 and 1987 had lost *Veronica praecox* and six other species and gained *Cirsium arvense*, *Galium aparine* and 18 other mostly weedy species. The gain in 'nitrophilous species' is attributed to air pollution. The only British contribution to this volume, by J. H. Dickson, is an account of the surprising abundance of *Epipactis helleborine* in ± urban habitats in Glasgow near the edge of the species' natural range.

The Ecology of Urban Habitats might be expected to cover much the same ground, but in character it is completely different. Oliver Gilbert is Reader in Landscape Architecture at the University of Sheffield. That fact alone says something about academic life in Britain: the practitioner of a marginally relevant discipline in one of our smaller cities has filled an obvious gap in the market for a student textbook in a subject with a direct bearing on the quality of life of most of the population of the country, and no one could have done it better. His text is thoroughly readable and amply illustrated by photographs, drawings and tables. Most of its chapters deal with habitat types – railways, roads, city parks, etc. – which are not all invariably urban. What is clear to and from Gilbert is the value in British cities of unmanaged sites (he calls them 'urban commons') often with unstable vegetation, which would be ignored in Prague and become woods of *Ailanthus* in Berlin.

Rodney Burton

Survey of Bookham Common

FORTY-NINTH YEAR

Progress Report for 1990

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General (C. B. Ashby*)

The new hut referred to in last year's Progress Report has proved to be well proportioned and a comfortable base for our operations. A set of warm curtains has been expertly made and generously presented by Miss Olive Maunder, and the five colourful and informative wall-charts which enliven the interior include the well-known *Identification Chart of British and Irish Dragonflies* reviewed in *Lond. Nat.* **69:** 118.

The hut affords convenient access to our records, identification keys and textbooks and, particularly in the short winter days, is valued as a warm, dry focal point for our monthly meetings. Members compare notes in informal discussions over a pot of tea at the end of the day, write up their observations in the hut Day-Book, and never go short of a lift to the station. Driveable access to the hut, by kind permission of The National Trust Warden, Mr Ian Swinnery, ensures that there are always one or two cars on hand.

The Survey Team has been delighted to welcome other groups to share the facilities of the hut during the year, and introduce them to the wild and beautiful Common which has occupied us for so long. On 8 April, a mild and sunny day, Miss Doreen Woods brought the Ramblers Section of the L.N.H.S. to see the Common newly leafed in spring. The Quekett Microscopical Club came on 15 September, and the work-bench in the hut was soon set up with a wealth of microscopes and video apparatus. Colonies of the distinctive algae *Pediastrum* and *Scenedesmus*, together with many rotifers and assorted freshwater invertebrates, were seen alive, well defined and greatly enlarged on a video monitor screen very soon after their collection. The efforts of Mr Ken Jones, a member of the Q.M.C., in bringing and setting up the necessary apparatus were greatly appreciated. Members were able to monitor a recording being made of the expansion and feeding behaviour of *Collotheca ornata*, a sessile rotifer of striking appearance. On 22 September Dr Ian Menzies and Professor John Owen led another of the periodical and always-enjoyed field meetings on the Common of the British Entomological and Natural History Society, resulting in the discovery of two species of the Chrysomelidae (Coleoptera) new to Bookham.

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The experiment was tried this year of offering seven one-day courses between 11 March and 12 August. Members of the Survey Team acted as course leaders and all the main aspects of the biology of the Common were covered. L.N.H.S. members who would welcome the establishment of a similar series of courses in the future are invited to make their wishes known.

From the Reports which follow it will be seen that the Survey Team has again made a number of significant contributions to our understanding of the ecology of the Survey area. Several groups of organisms have been brought into focus for the first time and some notable results have been achieved. The effects of the hot, dry summer of 1990 will be evident in some of the accounts. Perhaps the most obvious was the drying-up of South-East, Bayfield, Upper Eastern and Lower Eastern Ponds – by no means an annual event – during August and September, and the exceptionally low water levels of all the others. The silting of Lower Eastern Pond, and the rapid advance of *Typha* and *Sparganium*, has not gone unnoticed; but the control measures which cannot now be much longer delayed will be undertaken with prudence. It is indeed the presence of this abundant emergent vegetation which has led to Lower Eastern Pond becoming a major dragonfly and damselfly habitat.

A total of 22 aerial photographs of the Common was commissioned by the Society during the year. These are in the form of 10″ × 8″ coloured prints and show the vegetation and main topographical features of the survey area with clarity and in detail. They have been mounted and are a valuable source of reference. Monochrome enlargements of aerial photographs of the Common in 1947, 1961 and 1968 are extant for comparison. We are grateful to our member Mr David Martin for introducing the project and making all the necessary arrangements.

Members of the Society who have not yet tried their hand at Bookham may be sure of a warm welcome from the Survey Team, and any needed assistance in identifying a line of enquiry which could usefully and interestingly be undertaken. There is, for example, scope for botanical, entomological, zoological and chemico-physical studies in following the development of Kelsey's Pond, recently completely cleared and remade, as it matures.

It is with much regret that we report the deaths of two former members of the Bookham Survey Team. Mr A. H. Norkett died in January 1990 and an obituary incorporating an appreciation of his work on the algae, bryophytes and lichens at Bookham appears on page 169. Mr W. R. Ruttledge died in November 1990 and some previously unpublished contributions by him to the study of the Orthoptera are given on page 133.

Vegetation (Ken Page*)

Hybrids on the Common

In the Bookham Common Progress Report for 1986 (Page 1987) ten hybrids were listed including four involving *Salix* species which were reviewed in some detail. Since then a total of eighteen has been discovered on the Common and it is the purpose of this report briefly to outline these. To make this systematic list as complete as possible the *Salix* hybrids are included. Nomenclature follows *Hybridization and the Flora of the British Isles* (Stace 1975).

Spiraea × *billiardii* is a popular garden shrub now naturalised in some areas. It is considered to have the parentage *S. douglasii* × *S. salicifolia*, although other combinations may be grown under this name. Plants may be seen in Division M of the Common.

The genus *Rubus* is difficult for most amateur botanists. However, the cross between dewberry and raspberry (*R. caesius* × *R. idaeus*) does look distinctly different, especially if fruit is present. Named *R.* × *idaeoides*, this hybrid is arching in habit with the very glaucous stems of *R. idaeus*, whereas the large leaves with three to five leaflets (three in *R. caesius*, three to seven in *R. idaeus*) are much more akin to the latter. The fruit in short clusters is intermediate in shape and colour. It also grows in Division M.

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Prunus × *fruticans* results from the plum *P. domestica* crossed with the sloe *P. spinosa*. As the sloe is thought to be one of the ancestral parents of the plum the hybrid, in the widest sense, might be regarded as a backcross. Whatever the merits of this supposition the plant does look different in certain details: intermediate in growth between tree and shrub; leaves often large; flowers nearer to *P. domestica* in size and whiteness. The fruit is much nearer to *P. spinosa* in size but with the stone always (?) longer than broad; flattened and tapered to one end as in plum, not rounded as in sloe. The hybrid has been observed in Divisions P, Q and R.

Another member of the rose family is *Crataegus*, and the intermediate between *C. laevigata* and *C. monogyna* occurs in the woodland. Specimens observed appear morphologically closer to *C. laevigata*. The criteria used in identification have been leaf shape and indentation, flowering time (usually slightly earlier than *C. monogyna*), number of styles and nutlets, either one or two per fruit. Plants can be seen in Divisions G and P.

Woodland rides provide a good habitat for the dock hybrid *Rumex obtusifolius* × *R. sanguineus*. This cross between the broad-leaved and red-veined docks was determined by Dr A. C. Leslie. To a large degree sterile, its depauperate inflorescences provide a good clue to its hybridity. Also the lower leaves, cordate at the base and tapering at the apex, are intermediate between the species. It continues to grow on High Point Path in Division G.

Silver birch *Betula pendula* is a conspicuous feature of the Common: downy birch *B. pubescens* is rare. Species delimitation makes identification difficult but we conclude that specimens with any degree of mixed characters may be of hybrid origin. These are not uncommon and are generally intermediate in leaf shape and serration and the combined pubescence and wartiness of twigs. Examples of *B. aurata* (*B. pendula* × *B. pubescens*) can be seen along Hollow Path in Division K.

For many years a mature specimen of *Quercus* × *rosacea* (*Q. petraea* × *Q. robur*) has been known on the boundary of the Survey area in Division Q. Last year a young tree of this hybrid was discovered near Manor Cottage in Division P. As with *Betula*, species delimitation makes identification difficult, but both specimens possess intermediate characters such as petiole length, partial development of auricles, persistent stellate pubescence along the midribs on the leaf undersides and fruit peduncles of varying length.

The four *Salix* hybrids investigated in a previous report (*loc. cit.*) were:–

Salix alba × *S. fragilis*
S. aurita × *S. cinerea* ssp. *oleifolia*
S. caprea × *S. cinerea* ssp. *oleifolia*
S. viminalis × *S. cinerea* ssp. *oleifolia*

Herbarium specimens were determined by R. D. Meikle of Kew.

Russian comfrey *Symphytum* × *uplandicum* (*S. officinale* × *S. asperum*) was grown for fodder in the past and no doubt many plants are relics of cultivation. It grows alongside the main track to the Keeper's cottage in Division F. The hybrid can be confused with *S. officinale*, the only native species, but it does not have the conspicuously clasping stem leaves or the broadly winged stems of that species. Flower colour is either blue or blue-purple.

There are two mint hybrids on the Common. *Mentha* × *verticillata* (*Mentha aquatica* × *M. arvensis*) is almost certainly spontaneous, as both parents are well represented here. Appearing as a vigorous, hairier, somewhat sicklysmelling version of *M. arvensis* with included stamens and without fruit, it can be found in the damper areas of Division N.

Mentha × *villosa* (*M. spicata* × *M. suaveolens*) is certainly a garden throwout. It occurs as the form *alopecuroides*, a widespread vigorous variant which quickly develops extensive patches, and is easily recognised as a large-leaved, greyish-looking spearmint. It can be seen in Division Q.

Stachys × *ambigua* was recorded by A. W. Jones (1954). This hybrid between *S. palustris* and *S. sylvatica* then grew near Manor Cottage in Division Q. It still grows in this division at a different site. It also grows in a ditch on Commonside in Division M and despite being periodically cut back by the residents of a nearby house it flowers most years. Both clumps show a close affinity with *S. palustris* in flower colour and leaf shape. All plants appear sterile.

Nearby, in the same division is a clump of *Aster* × *salignus* (*A. lanceolatus* × *A. novi-belgii.*) Not easily separable from its parents, the following characters may be helpful: stem leaves auricled in varying degrees, involucral bracts mainly appressed but occasionally a few spreading partly, ray florets at first whitish or pale blue, becoming violet-blue as flowers begin to wither.

The bluebells frequently grown in gardens, and almost as frequently dispatched to the wild as they become too invasive under cultivation, are usually hybrids between the English bluebell *Hyacinthoides non-scripta* and the Spanish bluebell *H. hispanica*. They show hybrid vigour with large, usually broad leaves and flowers whose perianth segments spread outwards, but do not turn back completely as in *H. non-scripta*. Flower colour ranges from blue, through purple and pink to white. Anther colour may vary between cream and blue. It has been noted in a number of places, perhaps most characteristically in Divisions C and Q, in association with other garden rejects.

On the wet, sometimes waterlogged London Clay of the Common it is not surprising that rushes are widespread. Eight species grow here and two have hybridized. *Juncus acutiformis* × *J. articulatus* (*J.* × *surrejanus*) spreads vegetatively to form large conspicuous areas. In contrast with some reports from elsewhere in the U.K., at Bookham the plants more closely resemble the *J. acutiformis* parent. The habit is stiffly erect and the perianth segments are pale brown as in that species. Seed capsules are normally empty, but the few seeds that are occasionally found can be viable. The hybrid occurs extensively in many areas, particularly Division Q, and is much more frequent than *J. acutiformis*.

Finally, *Tritonia* × *crocosmiflora* (*T. aurea* × *T. pottsii*) is the montbretia of gardens and grows with other garden rejects in Division C.

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PAGE, K. 1987. Vegetation: willow hybrids. *Lond. Nat.* **66**: 158-159.
STACE, C. A., Ed. 1975. *Hybridization and the Flora of the British Isles.*

Algae (C. B. Ashby)

Dinophyceae

The superabundance in late summer of the motile dinoflagellate *Ceratium hirundinella* noted in previous years was experienced again in 1990. On 22 July it was present in vast numbers in Western Hollow Pond and perhaps in even greater profusion in the adjacent Eastern Hollow Pond.

On 12 August it was noted also in the Isle of Wight Pond, but not approaching the density continuing in Eastern Hollow. On that date the water of the latter appeared yellowish-brown or green over its entire surface, the shade of colour varying with the amount of sunlight penetrating the surrounding trees, becoming most intensely green where the surface of the water was fully lit. *Ceratium* placed in a white dish on a windowsill overnight were next morning colouring the water green on the side nearer the light. This prolific plankton alga appeared to have declined in Western Hollow by this date, but continued in abundance in Eastern Hollow until 22 September, when it was still in sufficient numbers to colour the water. The last few were noted in Eastern Hollow on 15 October.

This striking organism, visible with a good hand-lens as a cloud of animated pepper-dots, may be seen under the microscope to be covered with a reticulate pattern of shining, glass-like plates. To quote from Smith (1950), this possibly cosmopolitan alga 'differs from other dinoflagellates in that the anterior and posterior ends are continued in long horns. There is a single horn at the apical pole, and the posterior pole bears two or three antapical horns. Seasonal changes in the environment, especially changes in temperature, have a pronounced effect on the shape of cells of this species'. It is perhaps of interest to note that in all the thousands of examples examined at Bookham in this and other years (Ashby 1990) the number of antapical horns has been restricted to two. In a remarkable variant, noted in a sample from Eastern Hollow Pond on 22 September, the apical horn, normally smoothly tapering and straight, was branched. This malformation appeared to have no effect on the motility of the individual.

References

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SMITH, G. M. 1950. *The Fresh-water Algae of the United States.* McGraw-Hill Book Company, New York.

Fungi (Peter Holland*)

The only new fungus record for the Common reported this year is *Phleogena faginea* (Fr.) Link. Mrs Pamela Goldsmith found this Basidiomycete on oak bark in South-East Wood on 11 November and says she has never noticed it there before in the course of many visits. It is described by Ellis and Ellis (1985) as common on bark. It is, however, not striking enough to be seen by many observers, who may think it is a lichen. Its stalked fruiting structures occur in colonies, often abundantly, on the bark of fallen or standing oaks and other broad-leaved trees and are up to 7 mm tall, including the brownish spherical head up to about 3 mm in diameter. When fresh, a faint smell of curry may be detected, but this intensifies as the specimens mature and dry. This distinctive character persists in collections for many months or even years.

This is the only common species of the genus in temperate regions and is usually placed in the Auriculariaceae on account of the transversely septate basidia. It is one of a few genera without the gelatinous fruit-bodies typical of the family. *Phleogena* and similar genera with stipitate and capitate fruit-bodies are sometimes separated as the Phleogenaceae (McNabb 1973). Very few readily accessible books mention this species and I am grateful to David Mitchell for introducing it to me many years ago.

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McNABB, R. F. R. 1973. Phragmobasidiomycetidae: Tremellales. Auriculariales. Septobasidiales. In *The Fungi – An Advanced Treatise.* Ed. Ainsworth, G. C. *et al.* Academic Press, London.

Aschelminthes (L. V. Martin†)

Rotifera – *A Checklist of Species, 1941-1990*

A list of 16 species of rotifers collected on 13 June 1982 was given by C. G.

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Hussey in *Lond. Nat.* **62:** 90, and other records by Coles, Martin, Saunders-Davies *et al.* have appeared in the Progress Reports for 1969, 1983, 1987, 1988 and 1989. All published references back to the inception of the Survey have now been re-checked for records, and in the following list species recorded up to and including 1989 are marked *. The remaining 58 species listed, new to Bookham, were recorded by the writer in the course of 15 visits in 1990. The ponds sampled were:

Upper Eastern	28.iv
Lower Eastern	28.iv
Isle of Wight	8.iv, 13.v, 15.ix
South-East	11.iv, 25.iv, 13.v
Bayfield	29.iv, 18.v, 20.v
Crater	13.v
Kelsey's	20.v
Sheepbell	22.iv, 7.v, 23.v, 9.vi, 15.vii, 14.x

Cephalodella tinca v. *conspicua* Donner, collected from Upper Eastern Pond on 28 April, has been confirmed by E. D. Hollowday (*in litt.*) as the first record for Britain. A further rarity was *Cephalodella giganthea* Remane, found in Sheepbell Pond on 15 July; this is the second British record, the first being on Ranmore Common, Surrey, in 1981. Reproduction in the Rotifera is mainly parthenogenetic and males are seldom noted; males of *Lophocharis oxysternon* (Gosse) and *Mytilina ventralis* v. *brevispina* Ehr. were found in samples from Isle of Wight Pond on 8 April and Bayfield Pond on 18 May respectively.

Rotifers Found in Bookham Ponds up to 1990

**Anuraeopsis fissa fissa* (Gosse)
Asplanchna girodi De Guerne
**Asplanchna priodonta priodonta* Gosse
**Brachionus angularis angularis* Gosse
**Brachionus calyciflorus calyciflorus* Pallas
**Brachionus urceolaris* v. *rubens* (Ehr.)
Cephalodella ?deformis Donner
Cephalodella forficula (Ehr.)
Cephalodella gibba gibba (Ehr.)
Cephalodella giganthea Remane – second British record
Cephalodella globata (Gosse)
Cephalodella gracilis gracilis (Ehr.)
Cephalodella intuta Myers
Cephalodella ?nana Myers
Cephalodella remanei Wisniewski = *C. hoodi hoodi* (Gosse)
Cephalodella sterea sterea (Gosse)
Cephalodella tenuior tenuior (Gosse)
Cephalodella tinca v. *conspicua* Donner – first British record
Cephalodella ventripes ventripes Dixon-Nuttall
**Collotheca ornata ornata* (Ehr.)
Colurella colurus (Ehr.)
Colurella obtusa obtusa (Gosse)
**Conochilus* sp.
Dicranophorus caudatus caudatus (Ehr.)
Dicranophorus uncinatus (Milne)
Encentrum ?gulo Wulfert
Encentrum plicatum (Eyferth)
Encentrum saundersiae saundersiae (Hudson)
Erignatha clastopis (Gosse)
**Euchlanis dilatata dilatata* Ehr.
**Filinia longiseta longiseta* (Ehr.)
**Floscularia ringens* (L.)
Gastropus hyptopus (Ehr.)
**Keratella cochlearis cochlearis* (Gosse)
Keratella cochlearis tecta (Gosse)
**Keratella quadrata quadrata* (O.F.M.)
Keratella ticinensis (Callerio)
Lecane closterocerca closterocerca (Schmarda)
Lecane lunaris lunaris (Ehr.)
Lecane stichaea stichaea Harring
**Lecane* (mono) sp.
**Lepadella acuminata acuminata* (Ehr.)
Lepadella minuta (Montet)
**Lepadella ovalis* (O.F.M.)
Lepadella patella patella (O.F.M.)
Lepadella rhomboides rhomboides (Gosse)
Lepadella triptera triptera Ehr.
Lophocharis oxysternon (Gosse) – males included
Microcodides chlaena chlaena (Gosse)
Monommata longiseta (O.F.M.)
Mytilina crassipes (Lucks)
**Mytilina mucronata mucronata* (O.F.M.)
**Mytilina mucronata* v. *spinigera* (Ehr.)
Mytilina ventralis ventralis Ehr.
Mytilina ventralis v. *brevispina* Ehr. – males included
**Mytilina ventralis* f. *redunca* Ehr.
Notholca acuminata (Ehr.)
Notommata cerberus cerberus (Gosse)
Notommata cyrtopus Gosse
**Platyias quadricornis* (Ehr.)
Polyarthra dolichoptera dolichoptera Idelson

Polyarthra ?euryptera (Wierzejski)
Polyarthra vulgaris vulgaris Carlin
**Polyarthra* sp.
Pompholyx sp.
Proales fallaciosa Wulfert
Resticula melandocus (Gosse)
Rhinoglena frontalis frontalis (Ehr.)
Squatinella mutica mutica (Ehr.)
Squatinella mutica f. *tridentata* (Fresenius)
**Stephanoceros fimbriatus fimbriatus* (Goldfusz)
Synchaeta oblonga Ehr.
**Synchaeta pectinata* Ehr.
Synchaeta tremula (O.F.M.)
**Testudinella patina patina* (Hermann)
Trichocerca dixon-nuttalli Jennings
Trichocerca porcellus porcellus (Gosse)
Trichocerca rattus rattus (O.F.M.)
Trichocerca tenuior (Gosse)
Trichocerca vernalis Hauer
Wierzejskiella velox (Wiszniewski)

Gastrotricha

The gastrotrichs are minute, multicellular animals which occur in fresh and salt water, also in moss and wet leaves. The majority of freshwater species fall within the range of 90-350 µm long†, and most are in the family Chaetonidae: elongated, rather flat organisms with a forked rear end. Being small and rather transparent, gastrotrichs are not very obtrusive and have been little studied in Britain, but they are very widespread and most samples of mud from the bottom of ponds will present them. Further information on collection, examination and literature will be found in Martin (1981, 1990).

Of the 52 species at present recognised from fresh water in Britain, 23 species found to be occurring in the ponds at Bookham Common are now listed for the first time. Bayfield Pond and Sheepbell Pond were especially productive, with lesser numbers noted in all the other main ponds. The following list of gastrotrichs recorded at Bookham in 1990 includes five species new to Britain and one entirely new subspecies, *Chaetonotus ophiogaster intermedia* Martin, 1990.

† 1 mm = 1,000 microns (µm).

Aspidiophorus paradoxus Voigt
Chaetonotus brevispinosus Zelinka
Chaetonotus chuni Voigt
Chaetonotus disjunctus Greuter
**Chaetonotus greuteri* Remane
**Chaetonotus macrochaetus* Zelinka
Chaetonotus maximus Ehr.
Chaetonotus microchaetus Preob.
Chaetonotus ophiogaster ophiogaster Remane
Chaetonotus ophiogaster intermedia Martin
Chaetonotus persetosus Zelinka
Chaetonotus polyspinosus Greuter
Chaetonotus segnis Martin
Chaetonotus simrothi Voigt
Chaetonotus vellosus Martin
Dasydites goniathrix Gosse
**Heterolepiderma gracile* Remane
Heterolepiderma ocellatum (Metsch.)
**Ichthydium maximum* Greuter
**Ichthydium pellucidum* Preob.
Ichthydium podura (O. F. Müller)
Polymerurus nodicaudus Voigt (= *longicaudatus* (Tatem))
Setopus bisetosus (Thompson)

* first British record

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Crustacea: Cladocera (Compiled by C. B. Ashby)

General

The Cladocera or 'water-fleas' are among the most frequent and obvious of the small freshwater crustaceans, and there are many references in successive Progress Reports to their occurrence in the ponds, streams and temporary waters of the Common. A checklist of 26 species, together with a detailed record of their distribution and times of occurrence, was given by John Hearn in the Progress Report for 1974 (Hearn 1975), followed a year later by continued distribution records and seven species new to the list (Hearn 1976). One further addition, *Bosmina longirostris*, was noted in the Isle of Wight Pond on 28 June 1980 (Coles 1981).

Cladocera in 1990

Bosmina longirostris (O. F. Müller). Very high numbers present in the Isle of Wight Pond on 28 April (A. P. Saunders-Davies). Noted again in the same pond on 13 May (C.B.A.). This very small cladoceran, of distinctive appearance, tends to live on or near the surface of open water and appears to be less associated with submerged vegetation than some other species (J. Hearn, pers. comm.).

The following were recorded by E. D. Hollowday on 15 September:

Isle of Wight Pond
Ceriodaphnia pulchella Sars. Females with developing young.
Daphnia hyalina Leydig.

Eastern Hollow Pond
Ceriodaphnia pulchella Sars. Females with developing young.
Chydorus ovalis Kurz. A male.
Chydorus sphaericus (O. F. Müller) Females.
Macrothrix sp.
Scapholeberis mucronata (O.F.M.).

Mr Hollowday has contributed the following taxonomic notes:

> There has been considerable argument amongst Cladocera specialists for many years as to the exact relationship of *Daphnia hyalina* with *D. longispina* and the *galeata* and *cucullata* 'forms' of that species. Scourfield and Harding (1941), while treating *hyalina* as a separate species, remark that it is 'probably more correct to consider it as a synonym of *longispina* but less convenient than as a separate species'. I have not seen the latest (1966) edition of the above, but the French monograph (Amoros 1984) treats all four as separate species.
>
> The single example (dead) of *Macrothrix* sp. was especially interesting in that it did not exhibit the very fine, closely set serrations on the dorsal surface of the carapace characteristic of *M. laticornis* (Jurine), but instead had widely set, backwardly pointing 'teeth' quite different from anything I have seen published. One antennule was absent and the other damaged, thus denying the advantage otherwise to be obtained from these diagnostic features. It was unlike the infrequent *M. hirsuticornis* Norman and Brady, in which the dorsal surface of the carapace is smooth.

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Orthoptera: Recent Records (Ian S. Menzies*)

(I.S.M. records unless stated otherwise).

BLATTIDAE

Ectobius lapponicus (L.). This wild cockroach is established in most areas of Bookham Common. **Central Plain:** 6.vii.1986, 13.viii.1988, 1.vii.1989; **Bayfield Plain:** 14.vi. &

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15.vii.1989; **Western Plain:** 8.vii.1990. Obtained by sweeping low vegetation or by beating foliage of trees and shrubs. Often seen flying in hot weather.

TETRIGIDAE

Tetrix subulata (L.). In marshy areas, especially around the ponds. **Western Plain:** 14.vi.1989, several adults; **Bayfield Plain:** 14.vi.1989, several adults; 27.viii.1990, several adults in marshy area (I.S.M. and Roger Hawkins).

Tetrix undulata (Sowerby). Somewhat similar preferences to the last species, but also found in drier, grassy areas. **Western Plain:** 14.vi.1989, several adults; **Bayfield Plain:** 27.viii.1990, several adults in company with *T. subulata* (I.S.M. and Roger Hawkins).

ACRIDIDAE

Omocestus viridulus (L.). Well established in grassy areas on the Common. **Central Plain:** 20.ix.1989, plentiful; **Bayfield Plain:** 8.vii. & 14.vii.1990, plentiful.

Chorthippus brunneus (Thunberg). This generally common species is rather localised on Bookham Common. **Merritt's Cottage:** 17.vii.1990, in large numbers on open ground immediately outside the cottage; **Hollow Path:** 27.viii.1990, in grassy area.

Chorthippus parallelus (Zetterstedt). The most plentiful short-horn grasshopper on Bookham Common, present in most grassy areas. **Bayfield Plain:** 8.vii. & 14.vii.1990, abundant; **Western Plain:** 8.vii. & 14.vii.1990, abundant.

TETTIGONIIDAE

Leptophyes punctatissima (Bosc.). A green, apterous bush-cricket seen usually on low herbage, brambles, etc. Well established on Bookham Common. **Western Plain:** 8.vii.1990, one; and 27.viii.1990, several detected; and near **Merritt's Cottage:** 17.vii.1990, several found.

Meconema thalassina (Degeer). A fully winged pale-green bush-cricket found usually amongst the foliage of trees, especially oak. Well established on Bookham Common. **Western Plain:** 8.vii.1990, several; by **Hollow Path:** 27.viii.1990, one.

Pholidoptera griseoaptera (Degeer). A large, but very elusive, apterous, brown bush-cricket, found amongst brambles and other low vegetation, especially along woodland margins. Localised colonies are present. **Western Plain:** 21.viii. & 27.viii.1990, several found in two separate sites by path.

Conocephalus dorsalis (Latreille). A delicate-green brachypterous species which favours marshy areas with grass, rushes and sedges. Localised colonies are present. **Isle of Wight Plain,** at junction of I.O.W. and Bank's Path: 12.ix.1988, two; 1.x.1989, several; 8.vii.1990, one seen; 12, 21, 27.viii.1990, one seen on each occasion; **Western Plain** in two separate areas: 22.x.1988, two swept; 16.viii.1989, one seen; 8.vii.1990, several; 21, 27.viii., 1, 22.ix.1990, plentiful in both sites; near **Merritt's Cottage:** a small colony in grassy clearing observed on 12, 21, 27.viii.1990.

Conocephalus discolor (Thunberg). A fully-winged bush-cricket found previously in coastal areas from Dorset to East Sussex, and discovered originally on the southern undercliffs of the Isle of Wight. Some recent inland records do exist, *e.g.* St Catherine's Hill, Winchester. Favours both marshy and dry, grassy locations. Found in two sites on Bookham Common during August 1990, this is a new species for Surrey. By **Merritt's Cottage:** 12.viii.1990, a single male located, in company with *C. dorsalis*, by means of a bat-detector. It aroused suspicion by flying off, which the normally brachypterous *C. dorsalis* is unable to do! **Western Plain** (half a mile from the first site): 21.viii.1990, a male and a female (also in company with *C. dorsalis*).

Orthoptera: Some Early Records (Eric W. Groves*)

Several members of the L.N.H.S., if they were connected with the Bookham Common Survey during the decade following the end of World War II, may remember William R. (Bill) Ruttledge, who died in a nursing home at Brookthorpe, Glos. on 20 November 1990. When at Bookham during the 1950s he worked on short-horned grasshoppers (Orthoptera: Acrididae) in some selected areas of short grass on Central Plain (Castell 1952, Ruttledge 1954).

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Unfortunately he moved to Wiltshire before he had completed his investigations so his results were never published. Some while ago I asked him if he would give me a note of the species he had encountered. Brief though his note to me was I append it below so that these early records should not be lost.

Acrididae at Bookham Common, by W. R. Ruttledge

Omocestus viridulus (L.) and *Chorthippus parallelus* (Zett.). Both generally distributed on the Common.

Chorthippus brunneus Thunb. (*C. bicolor* (Charp.)). Found in the drier and shorter-grass areas of the Common and also used to occur on one of the rides in the Wood. [I think he meant Central Wood here – E.W.G.]

Stenobothrius lineatus (Panz.). Bank's Common and in very small numbers on my 'short-grass quadrat' on Central Plain.

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Hemiptera-Heteroptera (Ian S. Menzies)

(I.S.M. records unless stated otherwise)

RD = *Red Data Book* classification by the Nature Conservancy Council.

PENTATOMIDAE

Sehirus bicolor (L.). **Bayfield Plain:** 18.iv.1989; three, by sweeping.

Stollia fabricii (Kirkaldy). **Central Plain:** 18.ix.1988; two, by sweeping *Stachys sylvatica;* **Eastern Plain:** 16.viii.1989; one, by sweeping.

Dolycoris baccarum (Fabr.). **I.O.W. Plain:** 27.v.1989; one, by sweeping.

Aelia acuminata (L.). the 'Bishop's mitre'. This shield-bug, which inhabits grassy areas, is now very scarce in Surrey. **Bayfield Plain:** 11.ix.1988; one; and 28.viii.1989; one, by sweeping (I.S.M.); 22.ix.1990; one (Roger Hawkins); **Eastern Plain:** 12.viii.1989; one (I.S.M.); **Merritt's Cottage:** 27.viii.1990; one swept from grass clump in clearing adjacent to cottage (I.S.M. and Roger Hawkins).

Eurydema oleraceum (L.). the 'Brassica bug'. A rare and beautiful shield-bug found on various cruciferous plants. **Merritt's Cottage:** 17.vii.1990; one nymph discovered; then on 23.vii.1990, and for the next few weeks, adults and nymphs in large numbers on *Sisymbrium officinale* growing on disturbed soil in clearing adjacent to the cottage.

Zicrona caerulea (L.). **Western Plain:** 22.vii.1990; one, by sweeping.

COREIDAE

Gonocerus acuteangulatus (Goeze). *RD1*: the 'Box bug'. A very localised and rare species in Britain, found previously on *Buxus sempervirens* only in the immediate vicinity of Box Hill. There is a previous record for Leatherhead (10.vii.1933, F.J.C.). It has now been found, on a number of occasions during 1990, in several parts of Bookham Common. **Hill House Wood:** 14.i.1990; one adult beaten from holly growing under oaks; and 1.ix.1990; one adult from hawthorn (I.S.M.); **Central Plain:** 27.viii.1990; two adults, from oak and hawthorn (I.S.M. and Roger Hawkins); **Hollow Path:** 27.viii.1990; one adult on yew; one adult and one nymph from hawthorn (I.S.M. and Roger Hawkins); **Bayfield Plain:** 1.ix.1990; two adults and three nymphs, all on hawthorn (I.S.M.); and 27.ix.1990; one nymph (Roger Hawkins). The absence of box on Bookham Common and the fact that all the nymphs were found in association with hawthorn suggests that this may be an alternative foodplant.

NEIDIDAE

Metatropis rufescens (Herrich-Schaeffer). Near **Kelsey's Pond:** 3.vi.1988; one, on *Circaea lutetiana.*

LEDRIDAE

Ledra aurita (L.). 1.ix.1962; 'Swept from ditch under sallows – 1 record only' (Dudley Collins); **Eastern Plain:** 20.vii.1984; one, beaten from oak (I.S.M.).

Coleoptera (Ian S. Menzies)

(I.S.M. records unless stated otherwise)
RD = *Red Data Book* classification by the Nature Conservancy Council.

BUPRESTIDAE

With the discovery of *Agrilus pannonicus* all the British 'Jewel Beetles' of the genus *Agrilus* (three of which have *Red Data Book* status) have now been found on Bookham Common, a unique distinction which is shared, so far, only by the neighbouring Ashtead Common.

Agrilus pannonicus (Piller & Mitterpacher) – *RD2.* **Hollow Path** (between Lower and Upper Hollow Ponds): 16.vi.1990. Two adults were captured while flying around a dead oak stump in late afternoon sunshine between 4.30 and 5.0pm. The top of this tree had been blown off in the October 1987 gale, and was therefore being carefully watched for evidence of this species as it has already been found on Ashtead Common, and in Richmond and Bushy Parks. Emergence holes were first seen in the bark of this and another dead oak in the vicinity of Hollow Path on 2.vi.1990.

Agrilus laticornis (Illiger). This species has been found on Bookham Common, in small numbers, over a long period. **Upper Eastern Pond:** on 2.vi.1990 one, and on 4.vi.1990 two, beaten from sallows *Salix cinerea;* **Central Plain:** 8.ix.1990 three, beaten from various trees.

Agrilus angustulus (Illiger). **Hollow Path:** 4.vi.1990 several beaten from a fallen oak branch.

Agrilus sinuatus (Olivier) – *RD2.* **Central Plain** and **Bayfield Plain:** 20.vi.1990 three beaten from old hawthorns. Adults of this species are usually seen from mid-July to mid-September: this early date is due probably to the exceptionally early and warm summer of 1990.

Agrilus viridis (Linnaeus) – *RD2.* **Upper Eastern Pond:** 2.vi.1990 one male beaten from a damaged sallow. This is good news as the previous habitat (in Sheepbell Wood, June 1988) had been cut up for firewood.

MORDELLIDAE

Tomoxia biguttata (Gyllenhal) – *RD3.* **Upper Eastern Pond:** 8.vii.1990 one beaten from sallow. The only previous record of this species from Bookham Common is 30.vi.1953.

CERAMBYCIDAE

Phymatodes alni (L.). **Hollow Path:** 4.vi.1990 one beaten from dead oak branch in company with *Agrilus angustulus.* Not recorded from Bookham Common in recent years.

CHRYSOMELIDAE

Zeugophora flavicollis (Marsham) – *RD1.* **Bayfield Plain:** 1.ix.1990, a single adult beaten from a well-grown aspen in the vicinity of the Bayfield Pond: a new area on Bookham Common for this very rare species, previous records having been from the Eastern Plain.

Chrysolina menthastri (Suffrian). **Lower Eastern Pond:** 23.ix.1990; one adult found (J. Halstead) during the B.E.N.H.S. field meeting. Apparently no previous record from Bookham.

Gastrophysa viridula (Degeer). **Upper Eastern Pond:** 4.vi.1990 one swept from vegetation by the pond margin. Apparently no previous record from Bookham.

Phyllobrotica quadrimaculata (L.). **Lower Eastern Pond:** 23.ix.1990, one swept from *Scutellaria galericulata* by pond margin (I.S.M.) during the B.E.N.H.S. field meeting. Apparently no previous record from Bookham.

The following Halticini (flea-beetles), identification confirmed by Dr Michael Cox, appear to be new to Bookham Common:

Aphthona nonstriata (Goeze). **Bayfield Plain:** 18.ix.1988 one, 14.x.1988 one, 12.iv.1989 seven; by sweeping.

Longitarsus agilis (Rye). **Bayfield Plain:** 26.vii.1989 two, 2.viii.1989 four, 16.viii.1989 two, 18.ix.1989 one: by sweeping.

Longitarsus flavicornis (Stephens). **Bayfield Plain:** 22.vii.1989 one: by sweeping.

Altica lythri Aubé. **Bayfield Plain:** 28.viii.1988 one, 3.ix.1988 one, 17.v.1989 one, 19.v.1989 one; **Eastern Plain:** 2.x.1988 two: by sweeping *Epilobium*, etc. in marshy areas.

Altica palustris Weise. **Western Plain:** 12.viii.1987 one, 2-28.viii.1988 11, 3-18.ix.1988 18, 22 & 26.vii.1989 one each; **Bayfield Plain:** 6 & 17.v.1989 four, 24.ix.89 two: by sweeping, especially marshy vegetation.

Psylliodes napi (Fabricius). **Bayfield Plain:** 14.x.1988 two, 5 & 14.v.1989 three; **Central Plain:** 20.x.1988 two, 17.v.1989 two; **Western Plain:** 12.x.1989 one; **Eastern Plain:** 12.viii.1989 one: by sweeping.

Psylliodes weberi Lohse. **Western Plain:** 6 & 14.v.1989 four; **Central Plain:** 17.v.1989 one, 24.ix.1989 one: by sweeping.

ATTELABIDAE

Byctiscus betulae (L.). **Upper Eastern Pond:** 20.vi.1990, one beaten from sallow. This beautiful weevil has previously been found on three occasions, associated with aspens growing on the Eastern Plain, during June 1988.

Lepidoptera (Ian S. Menzies)

NYMPHALIDAE

Apatura iris – purple emperor. Like 1989, 1990 was a poor season for this species. **Hill House Wood:** 30.vi.1990: two males engaged in aerial disputes throughout the afternoon; **Mark Oak Gate:** 6.vii.1990: two or more males were seen in flight around a Turkey oak (K. J. Willmott).

Ladoga camilla – white admiral. This species has still not recovered from the disastrous July of 1988, and is at present confined to a few rides only. **The Broadway; High Point Path** and **Glade Path:** 26.vi.1990 three males; 30.vi.1990 about six seen; 6.vii.1990 six seen; 10.vii.1990 about six; 15.vii.1990 one seen; and 22.vii.1990: one seen on the annual National Trust Butterfly Walk (K. J. Willmott).

LYCAENIDAE

Strymonidia w-album – white-letter hairstreak. This species now seems to have returned to all of the elm areas of Bookham and Bank's Commons, *viz* **Tunnel Car Park; Bookham Station; Bank's Path** and **Isle of Wight Plain:** 15.vi.1990: two pupae were located on wych elms *Ulmus glabra*, by Bank's Path; 26.vi.1990: several adults seen in three different areas; 30.vi.1990: 10 to 15 seen; 6.vii.1990: six seen; 10.vii.1990: four, including an ovipositing female, seen; and 12.vii.1990: more than 20 seen, and another female ovipositing on English elm *Ulmus procera*, which seems to be the main foodplant at Bookham (*teste* K. J. Willmott). One on *Circium arvense* at the edge of Station Copse on 8.vii.1990; another at same place on 15.vii.1990 (Peter Gasson).

Quercusia quercus – purple hairstreak. Continues to thrive on the Common: 26.vi.1990: one adult seen; 30.vi.1990: about six, 6.vii.1990: about 12, and 10-12.vii.1990: many adults seen. On 23.vii.1990 eggs of this species were found, for the first time, on Turkey oak *Quercus petraea* (K. J. Willmott).

Thecla betulae – brown hairstreak. This is a scarce species north of the Guildford-Reigate escarpment in Surrey. **Western Plain,** by Bank's Path Bridge: 1.ix.1990: a worn male was photographed while it visited the flowers of golden rod and gipsywort (I.S.M.). During the 1985-86 winter and spring K. J. Willmott attached about 100 ova of this species to blackthorn in the same area, but considered this attempt at introduction was unlikely to succeed! *Thecla betulae* is seen occasionally, however, not far away on Ranmore Common.

HESPERIIDAE

Pyrgus malvae – grizzled skipper. Has continued to be seen on the Common in small numbers during recent years. **Central Plain:** 5 & 27.v.1989: single examples on each occasion; **Bayfield Plain:** 4.vi.1990: a male was seen by the stream (I.S.M.).

Odonata (Ruth Day*)

I have been making an annual census of the damselflies of Bookham Common for the last six years (Day 1987, 1988, 1989, 1990). I was not free to start work until July in 1985, the first year of the study, and because it was such a cold, wet summer I did not catch enough damselflies to be statistically significant until the end of the month. Ever since, I have made a point of taking my annual 'snapshot' of the population each year in the last week of July and first week of August to try to make sure that the data are comparable. Nature, however, takes more account of the weather than the calendar and last year I suspected that the main emergence of *Coenagrion puella* had occurred at the end of May and beginning of June, as a result of the long period of warm, sunny weather from May onwards. In 1990, therefore, I decided to make two brief surveys, the first at the end of May and the second at the usual date at the beginning of August.

The summer of 1990 was warm, sunny and very dry. I made my first visit to Bookham Common on 5 May and noted that both *Pyrrhosoma nymphula* and *Coenagrion puella* were on the wing. Until 1989, when I found a few individuals at Lower Eastern Pond, I had supposed *P. nymphula* was confined to Sheepbell Pond. In 1990 a few also occurred at South-East Pond, but nowhere on the Common is this species abundant. I was out netting damselflies on 24, 25 and 26 May and observed a female *Libellula depressa* ovipositing at South-East Pond on 24 May. I also saw a male and a female *L. depressa* at East Hollow on the same day as well as a male at South-East Pond on 26 May. A male was present at Lower Eastern Pond on 31 July and again on 2 August. A male *Anax imperator* was on the wing at Lower Eastern Pond on 24 May.

I found an estimated population of 440 male *Coenagrion puella* at South-East Pond on 25 May, a figure which resembles the July 1987 population of 397. The estimate for Lower Eastern Pond was lower: 102, suggesting that perhaps the main emergence at this pond was slightly later. When I returned on 31 July, I found that South-East Pond had become a miserable puddle, beside which perched a solitary male *C. puella* and Lower Eastern Pond still contained about a foot of water and had no *C. puella* at all. *C. puella* normally has a long flight period at Bookham. Bratton and Langlois (1984) report latest sightings of 28 August in 1982 and 26 September in 1983. I found it present in some abundance at the beginning of August from 1985 to 1989, but in 1990 the flight period was over on 31 July.

Lestes sponsa, on the other hand, which overwinters as an egg in diapause and does not emerge until the spring, was present in the usual numbers at Lower Eastern Pond. The estimated male population on 1 August was 228 (Tables 1 and 2).

Two male *Aeshna grandis* were hawking over Lower Eastern Pond between 31 July and 3 August, while I was there netting damselflies, and there were also two male *Aeshna cyanea* on 31 July. For the first time male *Sympetrum sanguineum* were sufficiently abundant at Lower Eastern Pond for it to be worth attempting mark/recapture. In fact I marked 19 of them with individual numbers and then had merely to read the numbers through a close-focusing monocular, without recapturing the insect. Table 3 shows which individuals were present on each of the four days. The Jolly formula gives a population estimate of 12, which at first seems too low, but these darters are strong fliers and it is quite likely that those dragonflies which did not reappear had emigrated to some other pond or river. The air temperature in the sun was 32°C on 2 August and 33°C on 3 August. The perching male darters pointed their abdomens straight up in the air to reduce the area exposed to the sun and avoid overheating.

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TABLE 1. Number of damselflies caught each day.

South-East Pond

Date	Air Temp. °C	Light 1,000 lux	Time B.S.T.	Damselflies caught							
				P. nymphula		*C. puella*		*I. elegans*		*L. sponsa*	
May				♂	♀	♂	♀	♂	♀	♂	♀
24	22	108	12.07	3	1	40	1	–	–	–	–
25	17	215	13.15	–	–	40	1	2	–	–	–
26	23	108	14.50	1	–	21	–	–	–	–	–
July											
31	24	27	12.15	–	–	1	–	–	–	2	–

Lower Eastern Pond

Date	Air Temp. °C	Light 1,000 lux	Time B.S.T.	Damselflies caught							
				P. nymphula		*C. puella*		*I. elegans*		*L. sponsa*	
May				♂	♀	♂	♀	♂	♀	♂	♀
24	22	108	13.37	2	–	40	–	1	–	–	–
25	17	215	11.30	1	–	15	1	–	–	–	–
26	16	108	13.30	4	–	18	–	–	–	–	–
July											
31	24	27	12.30	–	–	–	–	–	–	18	–
August											
1	29	108	11.35	–	–	–	–	–	–	34	–
2	31	108	12.00	–	–	–	–	–	–	28	–
3	33	108	12.25	–	–	–	–	–	–	27	–

TABLE 2. Population estimates using Jolly's stochastic method.

25 May	♂ *Coenagrion puella*	South-East Pond	441
		Lower Eastern Pond	102
1 August	♂ *Lestes sponsa*	Lower Eastern Pond	228
	♂ *Sympetrum sanguineum*	Lower Eastern Pond	12

TABLE 3. ♂ *Sympetrum sanguineum* seen at Lower Eastern Pond. Individuals identified by numbers.

																				Total seen each day
31 July	1	2																		2
1 August	–	2	3	4	5	6	7	8	9	10										9
2 August	–	–	–	–	5	–	7	–	9	–	11	12	13	14	15	16	17	18		11
3 August	–	–	–	–	5	–	–	8	–	10	–	12	13	14	–	–	17	–	19	8

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Birds (A. Merritt*)

Twelve visits to Eastern Wood were made by A. Merritt and Ron Kettle during the 1990 breeding season; 23 species bred and the numbers of territories/breeding pairs are listed below:

Sparrowhawk *Accipiter nisus*	1
Cuckoo *Cuculus canorus*	1
Great spotted woodpecker *Dendrocopos major*	1
Wren *Troglodytes troglodytes*	25
Dunnock *Prunella modularis*	1
Robin *Prunella modularis*	40
Blackbird *Turdus merula*	16
Song thrush *T. philomelos*	5
Blackcap *Sylvia atricapilla*	3
Chiffchaff *Phylloscopus collybita*	6
Willow warbler *Ph. trochilus*	2
Long-tailed tit *Aegithalos caudatus*	2
Marsh tit *Parus palustris*	3
Coal tit *P. ater*	6
Blue tit *P. caeruleus*	31
Great tit *P. major*	14
Nuthatch *Sitta europaea*	2
Treecreeper *Certhia familiaris*	2
Jay *Garrulus glandarius*	3
Magpie *Pica pica*	2
Carrion crow *Corvus corone*	2
Chaffinch *Fringilla coelebs*	3
Bullfinch *Pyrrhula pyrrhula*	2

All territory-holding species, except perhaps cuckoo, are considered to have bred. In addition, woodpigeon *Columba palumbus* probably and starling *Sturnus vulgaris* certainly bred. Other species recorded in the wood during the breeding season, but were not thought to have bred, are pheasant *Phasianus colchicus*, stock dove *Columba oenas*, collared dove *Streptopelia decaocto*, green woodpecker *Picus viridis*, mistle thrush *Turdus viscivorus*, garden warbler *Sylvia borin*, goldcrest *Regulus regulus* and redpoll *Acanthis flammea*.

A pair of sparrowhawks raised two young (R.K.). This is the first record of this species breeding in Eastern Wood for at least 10 years, although they have probably bred on other parts of the Common in that time.

Grey herons *Ardea cinerea*, which bred in Eastern Wood in 1988 and 1989, did not do so this year; the nest had been blown down, probably during the winter gales. However, a pair which bred in the adjacent Stent's Wood, in an area previously occupied by up to three pairs, had two young on 28 April. There were also a few other nests in Central Wood.

TABLE 1. Numbers of pairs of common breeding species in Eastern Wood, 1981-90, based on Beven (1981-89).

	1981	'82	'83	'84	'85	'86	'87	'88	'89	'90
No. of visits	?	6	?	17	–	–	4	6	9	12
Wren	23	33	21	27	–	–	21	24	32	25
Robin	28	28	26	26	–	–	29	31	38	40
Blackbird	20	14	13	12	–	–	10	12	17	16
Great tit	22	16	11	13	–	–	19	12	15	14
Blue tit	21	16	19	23	–	–	23	25	27	31

A brief look at the above table reveals the discrepancies in the number of counts each year which are partially reflected in the breeding totals. Hence the numbers are not strictly comparable. However, there does appear to have been a genuine steady increase in the robin and blue tit population, while populations of the other species appear to be stable.

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Great spotted woodpeckers are clearly below capacity in Eastern Wood with only one pair, while treecreepers are down from three pairs in 1989 to two pairs in 1990. Most species however appear to have had a successful breeding season in a year when weather conditions were favourable, with an abundance of insects in spring and early summer.

Other interesting breeding season observations include mutual feeding by a pair of nuthatches on 28 May, two long-tailed tits nest-building on 28 April, male marsh tit feeding female on 7 April, magpie and jay with nest material on 6 and 7 April respectively, and coal tit, presumed female, wing-quivering on 28 April. A female mallard *Anas platyrhynchos* was seen with 9 juveniles on Lower Eastern Pond on 23 June (A.M.), where moorhens *Gallinula chloropus* also bred (R.K.). A pair of jackdaws *Corvus monedula* was seen with nest material near Markoak car park on 11 April (A.M.).

No survey was carried out on the plains where many summer migrants were present, including cuckoo, turtle dove *Streptopelia turtur*, blackcap, many garden warblers and whitethroats *Sylvia communis*, two lesser whitethroats *S. curruca*, chiffchaff, willow warbler and at least three nightingales *Luscinia megarhynchos*.

Of the non-breeding species, of particular note was an immature night heron *Nycticorax nycticorax* by the ponds in April, seen and photographed by David Element. A skylark *Alauda arvensis* over square 82/83 on 2 May (R.K.) is also unusual for Bookham Common. On 11 October four teal *Anas crecca* flew over the ponds (R.K.).

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Other Vertebrates (A. Merritt)

Very few records were received of mammals, reptiles, amphibians or fishes.

Grey squirrels *Sciurus carolinensis* showed no signs of any decrease. Roe-deer *Capreolus capreolus* were seen in Eastern Wood on 7 (2), 11 and 28 April, 1 May and 24 June. The individual seen on 11 April was melanistic. Roe-deer are by no means confined to Eastern Wood and visits to other parts of the Common should show how widespread they are. In 1987 they were seen no less than 73 times (Beven 1988).

On 28 April a grass snake *Natrix natrix* was seen in Eastern Wood (A.M.). This species is often seen on sunny days in early spring shortly after emergence from hibernation.

On 12 July 3-4 large common carp *Cyprinus carpio* were seen in Eastern Hollow (A.M.).

Reference

BEVEN, G. 1988. *Lond. Nat.* **67:** 156.

Epiphytic Bryophytes at Bookham Common

By the late O. B. J. French

Our thanks are due to Mrs Kathleen M. French for allowing us to publish her late husband's paper and to Mr R. C. Stern for editing the draft manuscript.

Summary

An investigation was carried out on the bryophytes occurring as epiphytes in a part of Bookham Common. Several species were found on a wide range of trees and shrubs, but there was no grouping of species in relation to the main habitats investigated – boles and roots/bases. A number of factors concerning the occurrence of epiphytic bryophytes are discussed.

Introduction

A very limited variety of species taken together with the fact that the growth of those that do occur there is depauperate makes the Bookham Common epiphytic bryophyte flora dull. That is one point of view. Another is that since the Bookham plants do not 'go according to the book' (as I shall endeavour to show later) they form an extremely interesting community.

For a long time the somewhat limited Bookham bryophyte flora has been ascribed to pollution but, however true that may have been in the past, it does not appear to be correct now.

A more likely cause of our relatively poor epihytic flora lies in the local weather. Those well acquainted with the Common are inclined to regard it as a very wet place because of the persistent mud, but in point of fact it is a relatively dry area when compared with the south-west of the county which boasts a luxuriant bryophyte flora.

As far as the epiphytic flora is concerned it is also probable that mixed oak/birch woodland on London Clay does not carry a sufficient number of phorophytes suitable for supporting a vigorous and varied bryophyte community.

The main body of Bookham woodland comprises botanical Areas A/L inclusive with small patches in areas S, M and T plus a marginal fringe of woodland of varying width running down the western border and along stream banks (Figure 1). The trees growing in the wetter areas carry some of the more interesting and rarer bryophyte species.

The Bookham Epiphytic Bryophytes

Since 1972 the following epiphytic bryophytes have been recorded on the Common – F = facultative; O = obligate.

Nomenclature according to Corley and Hill (1981).

HEPATICAE

Metzgeria temperata	O	*Radula complanata*	O
M. furcata	F	*Frullania dilatata*	O
Lophocolea cuspidata	F	*Lejeunea ulicina*	F
L. heterophylla	F		

MUSCI

Dicranoweisia cirrata	F	*Orthotrichum lyelli*	O
Dicranum scoparium	F	*O. affine*	O
D. montanum	O	*O. diaphanum*	F
D. tauricum	O	*Ulota crispa*	O
Tortula laevipila	O	*Leskea polycarpa*	O
T. latifolia	O	*Amblystegium riparium*	F

Orthodontium lineare	F	*Isothecium myosuroides*	F
Bryum capillare	F	*Brachythecium velutinum*	F
B. flaccidum	O	*Rhynchostegium confertum*	F
Plagiomnium affine	F	*Hypnum cupressiforme* var. *cupressiforme*	F
Zygodon viridissimus	F	*H. cuppressiforme* var. *resupinatum*	F
Z. conoideus	O	*H. mammillatum*	F

Very occasionally most of the obligate epiphytes may be found in other situations, but the facultative species frequently occupy different habitats. Possibly the situation at Bookham is unusual, but none of the liverworts shown as being facultative has been found on the Common other than on trees or shrubs apart from the two *Lophocolea*. Among the mosses all are known only as epiphytes with the exceptions of *Orthodontium lineare, Bryum capillare, Amblystegium riparium, Isothecium myosuroides, Brachythecium velutinum, Rhynchostegium confertum* and *Hypnum cupressiforme* var. *cupressiforme*.

The Epiphytes' Habitat

The habitat of epiphytes is highly specialised and plants adopting it have to adapt to frequent and sometimes prolonged periods of aridity or perish; in fact it seems likely that to at least some species of epiphytic bryophytes periodic desiccation may have become a requirement of their natural cycle (Dr Francis Rose *in litt.*). Many of the species found in this situation have become poicilohydric with leaves which curl under dry conditions to preserve moisture, but which resume normal metabolism when moister conditions return.

The degree of dehydration which epiphytes suffer depends to a large extent upon the part of the phorophyte on which they grow. Many bryophyte species are intolerant of the battering effect of frequent, direct rainfall and their survival depends entirely upon atmospheric humidity. This is always highest at soil level and decreases rapidly with height above ground away from moist soil and the effects of transpiration by the surface vegetation, but it begins to increase again as the canopy is approached and, within the canopy itself, humidity is relatively high (Barkman 1958).

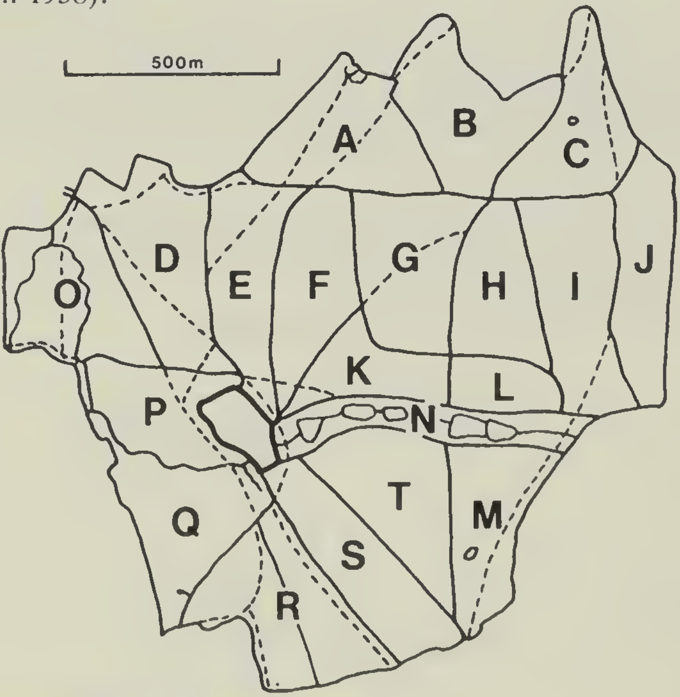

FIG. 1. The Bookham Common Survey Areas.

Despite the evidence to the contrary based upon the persistently muddy conditions prevailing on the Common, it is in fact a comparatively dry area compared with the hilly, woody terrain of the Hindhead district where figures supplied by the East Surrey and the Mid-Southern Water Companies covering the ten years 1976/1985 inclusive show that the south-west of the county averaged over this period 4.8% more rain days and 26% higher rainfall than occurred at Bookham. The consequent lower humidity prevailing on the Common is no doubt one of the reasons for the poverty of its bryophyte flora when compared with the variety and luxuriance of that in the Hindhead area.

Barkman (1958) stated that the levels of humidity to be found in the micro-climates of the trunks and boughs of trees depends not only on the incidence of rainfall or the prevelance of mist, but also on the water absorbtion capacity of the bark. He also described in detail discrete communities of bryophyte species which were typical not only of specific phorophytes, but also of particular areas on the trees where they grew. It was in the hope of establishing the composition of similar communities at Bookham that this survey was begun.

Method of Study

The woodland stands on a uniform and mildly acid bed of London Clay, the composition of the wooded areas is similar throughout and the epiphytic flora varies little from one area to another. Area A was taken as being typical of the rest of the wooded blocks and was subjected to a thorough examination over a period of 15 months in 1985 and 1986.

No claim is made to have examined every tree and shrub growing within Area A, but a strenuous effort was made to come as close as possible to this ideal.

Bryophytes do not normally grow on small plants so saplings and low-growing shrubs were ignored. Old tree-stumps, providing a different habitat were also excluded.

Two species of oak occur at Bookham, the Turkey oak *Quercus cerris* and the pedunculate oak *Q. robur*. The original intention was to distinguish between these species throughout the survey, but the difficulties in making definitive specific determinations in winter made this impossible and I decided to follow the advice of Dr Francis Rose and grouped them together. Nevertheless, whenever specific identification was possible it was clear that while *Q. robur* carried several bryophyte epiphytes, *Q. cerris* was chiefly barren. The reason for this difference between the two species of oak is very far from being clear and, since I was unable to obtain facilities for accurate laboratory bark tests, I could not take the investigation any further. However it was pointed out to me by Dr E. W. Jones (*in litt.*) that *Q. petraea* has bark which is considerably more acid than that of *Q. robur*, so the possibility remains that *Q. cerris* may also have a low pH factor. It is also possible that the bark of *Q. cerris* has a lower water absorbtion capacity than that of *Q. robur* making the microclimate occupied by bryophytes too dry. My impression at Bookham has been that the bark of *Q. cerris* is usually a good deal paler than that of *Q. robur* which might be an indicator of this, but I can only speculate on this point.

So far no work has been done to establish the proportions of *Q. cerris* to *Q. robur* on the Common. I have discussed this with Ken Page who is of the opinion that the ratio is probably about 1 to 4.

Barkman (1958), in his monumental treatise, lists several zones on trees and catalogues the bryophyte species commonly found on each. My activities, unfortunately, were limited to the distance I could reach from the ground, so anything growing higher up had to be neglected. My original intention was to distinguish between root, base and bole areas, but in the event this proved impractical because of the difficulty of finding a dividing line between root and base. I therefore decided to content myself with two zones only, the base to include the roots, and the bole of the tree, the dividing line between the two being the point on each tree above the root buttresses where the sides of the trunk become parallel or nearly so.

Results

Table 1 shows the distribution of bryophytes on the different phorophytes at Bookham while Table 2 shows their distribution in terms of growth on bases and boles of the phorophytes. Table 1 shows that the distribution of bryophyte

TABLE 1. The epiphytes and their distribution among the phorophytes. Figures in brackets indicate the number of records.

HEPATICAE		
Lejeunea ulicina (Tayl.) Gott., Lindenb. & Nees (3)		Oak (3)
Lophocolea cuspidata (Nees) Limpr. (47)	Ash (1) Birch (5) Elder (1) Elms (2) Hawthorn (2) Hazel (2)	Hornbeam (8) Horse-chestnut (1) Oak (20) *Prunus* (1) Sycamore (2) Willow (2)
L. heterophylla (Schrad.) Dum (37)	Ash (3) Birch (3) Elm (2) Hazel (1)	Hornbeam (2) Horse-chestnut (1) Oak (26)
Metzgeria furcata (L.) Dum.	Oak (1)	
MUSCI		
Amblystegium serpens (Hedw.) Br. Eur.	Oak (2)	
Atrichum undulatum (Hedw.) P. Beuv.	Birch (1)	Oak (9)
Brachythecium rutabulum (Hedw.) Br. Eur. (33)	Ash (1) Birch (4) Elder (3) Elm (1)	Hornbeam (4) Oak (20) Sycamore (2)
B. velutinum (Hedw.) Br. Eur. (7)	Ash (1) Elder (1)	Oak (4) Sycamore (1)
Dicranella heteromalla (Hedw.) Schimp. (8)	Hornbeam (1) Oak (6)	Willow (1)
Dicranoweisia cirrata (Hedw.) Lindb. ex Milde (36)	Ash (6) Birch (1) Elder (3) Elm (1)	Hawthorn (1) Hornbeam (3) Oak (21)
Dicranum montanum Hedw.	Birch (1)	
D. scoparium Hedw.	Hawthorn (1)	Oak (5)
Eurhynchium praelongum (Hedw.) Br. Eur.	Birch (2) Elder (5) Hawthorn (1) Hornbeam (4)	Oak (14) *Prunus* (1) Willow (1)
Hypnum cupressiforme var. *cupressiforme* Hedw.	Ash (6) Birch (3) Elder (5)	Hawthorn (1) Hornbeam (2) Oak (28)
H. cupressiforme var. *resupinatum* (Tayl.) Schimp.	Elm (2) Hornbeam (2)	Oak (50) Sycamore (1)
H. mammillatum (Brid.) Loeske	Ash (6) Sycamore (1)	Oak (56)
Isothecium myosuroides Brid.	Oak (1)	
I. myurum Brid.	Oak (1)	
Mnium hornum Hedw.	Horse-chestnut (1)	Oak (5)
Orthodontium lineare Schwaegr.	Oak (4)	
Orthotrichum affine Brid.	Elder (1)	
Rhynchostegium confertum (Dicks.) Br. Eur.	Ash (1)	Oak (2)
Zygodon viridissimus (Dicks.) Br. Eur.	Oak (1)	

epiphytes is relatively wide and that there are few which are confined to particular species of tree or shrub. Table 2 shows that the majority of bryophyte species may be found both on the bases as well as the boles of trees.

Stern and French (1983) took the view that *H. cupressiforme* var. *resupinatum* and *H. mammillatum* were fairly rare taxa. This opinion has had to be revised in the light of recording done in Area A which shows that these are the commonest epiphytes and that there is little to choose between the abundance of *H. cuppressiforme* var. *resupinatum*, *H. mammillatum* and *H. cupressiforme* var. *cupressiforme* when this occurs as an epiphyte and, in fact, that all are relatively common on the Bookham trees.

TABLE 2. The epiphytes and their distribution between the bases and boles of the phorophytes. Figures indicate the number of records.

	Base	**Bole**
HEPATICAE		
Lejeunea ulicina (Tayl.) Gott., Lindenb. & Nees	2	1
Lophocolea cuspidata (Nees) Limpr.	26	21
L. heterophylla (Schrad.) Dum.	32	5
Metzgeria furcata (L.) Dum.	1	—
MUSCI		
Amblystegium serpens (Hedw.) Br. Eur.	1	1
Atrichum undulatum (Hedw.) P. Beauv.	10	—
Brachythecium rutabulum (Hedw.) Br. Eur.	27	8
B. velutinum (Hedw.) Br. Eur.	6	1
Dicranella heteromalla (Hedw.) Schimp.	7	1
Dicranoweisia cirrata (Hedw.) Lindb. ex Milde	5	31
Dicranum montanum Hedw.	1	—
D. scoparium Hedw.	5	2
Eurhynchium praelongum (Hedw.) Br. Eur.	18	10
Hypnum cupressiforme var. *cupressiforme* Hedw.	30	15
H. cupressiforme var. *resupinatum* (Tayl.) Schimp.	38	17
H. mammillatum (Brid.) Loeske	39	24
Isothecium myosuroides Brid.	1	—
I. myurum Brid.	1	—
Mnium hornum Hedw.	6	—
Orthodontium lineare Schwaegr.	4	—
Orthotrichum affine Brid.	—	1
Rhynchostegium confertum (Dicks.) Br. Eur.	2	1
Zygodon viridissimus (Dicks.) Br. Eur.	—	1

The *Hypnum cupressiforme*-type fruits freely in moist situations such as the bark of fallen trees, but capsules are rarely seen when the plant grows in the much drier habitat of erect trunks. As far as I am aware *H. mammillatum* has never been found in fruit on the Common.

During the course of the survey I looked for rain tracks. While Barkman (1958) found specialised colonies of epiphytes occupying the rain tracks on trees, I noticed that at Bookham these areas, which were mostly confined to the older trees, were invariably barren.

Dicranum scoparium was only recorded on six trees and appears at Bookham to require a humus substrate of wind-blown detritus in bark crevices in order to establish itself. *Dicranum montanum* occurs on the base of a birch tree where it was first found, new to Bookham Common. This is not a common moss in Surrey, although Gardiner (1981) states that it is increasing.

Although *Quercus* outnumbers all the other genera in respect of epiphytic bryophytes, it will be noted that a high proportion of the trees were barren (Table 3). This is no doubt partly attributable to the inclusion of *Q. cerris*.

TABLE 3. Breakdown of the genera of phorophytes.

	Bryophyte bearing	**Barren**	**Total**
Acer	2	2	4
Aesculus	1	—	1
Betula	9	71	80
Carpinus	8	18	26
Castanea	2	—	2
Corylus	3	—	3
Crataegus	3	2	5
Fraxinus	14	13	27
Prunus	1	—	1
Quercus	108	77	185
Salix	2	—	2
Sambucus	7	—	7
Ulmus	7	—	7

Betula is second only to *Quercus* in terms of numbers found in the wood, but it attracts few bryophytes. One reason for this is the extreme acidity of the bark and another is the fact that this bark is flaky and does not provide a stable substrate for plant growth. Genera such as *Fraxinus* and *Sambucus*, well-known elsewhere for the variety of epiphytes which they bear, show poorly here. *Sambucus* is almost barren in Area A where it seems the exclusion of light by the high canopy prevents the plants' proper growth.

All the *Ulmus* examined were dead trees, but I included them in the recording process since the bryophytes they carried were of the same species as those found on living trees.

During the study of Area A, it appeared that most of the trees bearing epiphytes had a diameter of around 30 cm, those that were much smaller usually being barren except at their bases; on the other hand the larger and older oaks bore little on their trunks although they usually carried large cushions of mosses on large, lower boughs.

Examination of the Crowns of Storm-damaged Trees

The violent storm of October 1987 did a good deal of damage at Bookham, but while other trees fell like ninepins *Quercus robur* merely lost much of their crowns and a golden opportunity was offered for examining the twigs and branches of trees which had been inaccessible previously.

Nothing surprising was found except to remark that very little seems to grow on the upper branches of the Common's trees and the only species to disclose appreciable bryophyte colonies was *Q. robur*, but even here there were no surprises and the record simply shows the common species already noted from trunks and bases.

Discussion

One of the objects was to establish whether anything approaching the discrete associations of compatible species such as Barkman (1958) describes as commonly occurring not only on different tree species, but also on different locations on them were to be found at Bookham. The results of this survey show that at least for Area A no such groupings of epiphytic bryophytes exist. As Area A had been selected as typical of the wooded areas, it is likely that this applies generally at Bookham, although Dr Francis Rose tells me (*in litt.*) that in the more favoured areas of the south-west of Surrey and elsewhere they do indeed occur.

During the course of work on the Bookham woodlands I was unable to obtain facilities for bark analysis and so have had to rely to a large extent upon the data provided in his tables by Barkham (1958). On this basis the bark of the majority of trees found at Bookham is largely moderately acid to extremely so, another factor limiting the variety of the epiphytic bryophyte flora.

The degree of exposure is also an important governing factor in the growth of epiphytic bryophytes; few grow on isolated trees in open country and when they do occur in these situations they are most likely to be found on the side providing the greatest protection from direct rainfall and the dehydrating effects of wind and sunshine. In the Bookham woodlands it was found that on the trees bordering the woods at the margins of open farmland the bryophytes tended to grow on the woodland side; away from the woodland edges where neither direct rainfall nor direct sunlight affects the trunks of trees the bryophytes tended to grow where least affected by wind, but since wind is deflected by obstacles and in woodland may often appear to blow from the reciprocal direction to the true wind, the sides of trees occupied by bryophytes varied very considerably; and in the most sheltered places in the middle of woods epiphytes would sometimes grow all round the circumference of trunks.

Although not as sensitive as lichens, bryophytes are much affected by pollution, but the degree to which the Common is subjected to this danger today is very uncertain. Lichen studies at Bookham (Laundon 1973, 1981) showed that despite a significant decline in the flora since 1956 was established in 1973, the situation had stabilised by the time the 1980 examination was conducted. Mr J. R. Laundon (*in litt.*) remarks that there has probably been a decline in SO_2 levels in recent years and confirms that this has given rise to an improvement in the position of lichens in London although the rural populations show little change. Mr R. C. Stern (pers. comm.) points out that Forestry Commission instruments installed near Farnham show that there is a negligible amount of SO_2 in the atmosphere at present. However there appears to have been no noticeable improvement in the bryophyte flora at Bookham since the conclusion of the 1972/1981 survey (Stern and French 1982). It might be rash to draw optimistic conclusions about the recovery from the number of new Area records and the few new species discovered during the seven years since the previous work was completed.

Nevertheless, it is to be hoped that bryologists will work in the future at Bookham Common and will be able to find new species there. In respect of epiphytic bryophytes, the results of this investigation may be of interest at some future date when a further study of the epiphytes may be undertaken.

Acknowledgements

Dr Francis Rose and Dr E. W. Jones have both given me much useful comment and advice and I am most grateful to them. The late Mr E. C. Wallace also gave me much help and was always interested in the bryological work at Bookham. Finally, I thank Mr Rod Stern for his advice and encouragement during the course of this study.

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Book Review

A Review of Butterfly Introductions in Britain and Ireland. By M. R. Oates and M. S. Warren. A contract report for the Joint Committee for the Conservation of British Insects published by the Worldwide Fund for Nature. 1990. 96 pp. A4 paperback. No ISBN. Obtainable from WWF, Panda House, Weyside Park, Godalming, Surrey GU7 1XR, £8.50 + s.a.e. 55p. Cheques payable to WWF-UK.

The introduction of plants and animals to the wild has always been a thorny, if not divisive issue – never more so than when butterflies are involved. Three clear 'camps' are evident; those enthusiastically in support, those dead against and those who have the courage to admit a lack of sufficient knowledge to make a decision. Sadly, subscribers to either of the first two opinions frequently owe their allegiance to ignorance. This review of the situation has, therefore, long been needed and I am pleased to discover that it satisfactorily plugs the gap.

The work begins with a useful definition of terms, including the subtle differences between 'introduction', 're-introduction', 'establishment' and 'reinforcement'. Those who consider this to be hair-splitting should certainly read this report carefully and discover just how ignorance and lack of a strict 'scientific' approach has resulted in nearly 80% of establishments of butterflies ending in failure. A review of the role of wildlife establishments and particularly of the role of these within the context of butterfly conservation follows and is valuable reading. The 'meat' of the review, however, is an in-depth historical summary of butterfly releases in Britain and Ireland together with summaries of all known releases by species.

The purpose of the review is not to examine the case for and against releases nor to develop any policy for future attempts, although it does end with a list of 13 recommendations, all of which seem commendable. The aim has been to summarise the history of releases and examine how establishment could best be directed towards a useful conservation purpose. In this it certainly succeeds and, not withstanding a veritable plethora of typographical and similar errors, is certainly a document that could be consulted by anyone, be they county conservation trusts or wildlife gardeners, before even planning a butterfly release of any kind.

Experience shows that contract reports such as this are frequently difficult to obtain and the reader is therefore reminded that the review copy of all works reviewed in *The London Naturalist* is deposited in the Society's library.

COLIN W. PLANT

A Preliminary List of the Hemiptera-Homoptera (Auchenorhyncha) of Bookham Common, Surrey

By ERIC W. GROVES*

Introduction

This list is based on collections made of this insect group on Bookham Common by F. J. Coulson (F.J.C.), E. W. Groves (E.W.G.), W. J. Le Quesne (W.J.LeQ.) and D. Collins (D.C.), together with some incidental records by Col. C. J. F. Bensley (C.J.F.B.), A. E. Le Gros (A.E.LeG.), C. B. Ashby (C.B.A.) and I. S. Menzies (I.S.M.).

No claim is made as to its completeness for there are obvious gaps, especially amongst the Macropsinae and Typhlocybinae which ought to have representatives present in a habitat of oak woodland and grassland such as found at Bookham Common that has been little disturbed by man over hundreds of years. It is felt necessary to place this note of existing captures on record to provide a starting point on which future studies of these insects on the Common might be built.

I am grateful to Mr Dudley Collins for permission to incorporate the results of his valuable fieldwork (Collins 1971) on the leafhoppers of Bookham between 1962 and 1971, and to Mr Carl Harrison, Archivist at Lewisham Library, for his assistance.

The nomenclature and arrangement of species are in accordance with the current checklist for the British Auchenorhyncha (Le Quesne and Payne 1981).

CICADOMORPHA

CERCOPIDAE

Cercopis vulnerata Illig. – 8.v.1955, sweeping grass, Central Plain (E.W.G.); 21.vi.1955, sweeping dry grass area, Eastern Plain (E.W.G.); 8.vii.1956, sweeping in damp grass area, I.O.W. Plain (E.W.G.); v,vi.1964 and v.1966, locally common (D.C.); 1971, a single example turned up in a pitfall trap set for spiders on Eastern Plain (A.E.LeG.).

Aphrophora alni (Fall.) (syn. *A. spumaria* auctt.) – vi-x, abundant (D.C.).

Aphrophora costalis Mats. (syn. *A. maculata* Edw.) – 9.x.1955, by beating *Salix cinerea* along Broadway (South) (E.W.G.); viii.1963, and vii,viii,ix.1964, on *Salix caprea*, not common (D.C.).

Aphrophora salicina (Gze.) (syn. *A. salicis* (DeGeer)) – viii.1963, vi,vii.1964, on sallows, not common (D.C.).

Philaenus spumarius (L.) (syn. *P. leucophthalmus* (L.)) – 10.vii.1955, sweeping dry grass area, Eastern Plain (E.W.G.); 26.ix.1955, sweeping along the sides of Common Road South by Eastern Plain (E.W.G.); 13.ix.1956, sweeping dry grass area Eastern Plain (E.W.G.); vi-x, abundant (D.C.); 1971, a single example turned up in a pitfall trap set for spiders on Eastern Plain (A.E.LeG.).

Neophilaenus lineatus (L.) – 8.xi.1953, sweeping damp grass area, I.O.W. Plain (E.W.G.); 16.x.1955, sweeping dry grass area, Eastern Plain (E.W.G.); vi-x, abundant (D.C.).

MEMBRACIDAE

Centrotus cornutus (L.) – 9.vi.1934 (F.J.C.); 10.viii.1947, a single specimen (C.J.F.B.); 21.vi.1955, by sweeping in regenerated vegetation which included young *Quercus robur* in a cleared area, Central Wood (E.W.G.); 10.vi.1990, one in low vegetation in open area east of Merritt's Cottage (C.B.A.).

CICADELLIDAE

Ledra aurita (L.) – 1.ix.1962, a single specimen swept from a ditch under sallows (D.C.); 20.vii.1984, one beaten from oak, Eastern plain (I.S.M.).

Cicadella viridis (L.) – 4.x.1953, sweeping damp grass area, I.O.W. Plain (E.W.G.); 12.viii.1956, swept from a dry grass area on Eastern Plain and along Common Road

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*143 Westleigh Avenue, Coulsdon, Surrey CR5 3AF.

(South) (E.W.G.); 26.ix.55, by sweeping vegetation on I.O.W. Pond culvert (E.W.G.); vii-x, abundant in damp areas (D.C.).

Evacanthus acuminatus (Fab.) – 8.vii.1956, sweeping in Kelsey's clearing just south of Kelsey's Pond (E.W.G.); ix.1962 and vi.1964, occasionally by sweeping (D.C.).

Evacanthus interruptus (L.) – viii,ix.1962 and vi.1964, fairly common (D.C.).

Idiocerus albicans Kb. – viii.1963 and vii,viii,ix.1964, common on white poplar *Populus alba* (D.C.).

Idiocerus confusus Flor. – 9.x.1955, beating *Salix cinerea* along Broadway (South) (E.W.G.); vi-ix, common on sallows (D.C.).

Idiocerus distinguendis Kb. – 9.ix.1951, on white poplar *Populus alba* (W.J.LeQ.); viii,ix, locally common on aspen *P. tremula*, grey poplar *P. canescens* and white poplar *P. alba* (D.C.).

Idiocerus elegans Flor. – vii-ix, not infrequent on sallows and occasionally on crack willow *Salix fragilis* (D.C.).

Idiocerus fulgidus (Fab.) – ix.1964, on Lombardy poplar *Populus nigra* 'Italica' (D.C.).

Idiocerus lituratus (Fall.) – 16.x.1955, sweeping sallows along Tunnel Path (E.W.G.); vii-x, common on sallows (D.C.).

Idiocerus populi (L.) – 16.x.1955, sweeping aspen *Populus tremula* along Tunnel Path (E.W.G.); 8.x.1969, in colonies on aspen (D.C.).

Idiocerus stigmaticalis Lewis – 9.x.1955, by beating *Salix cinerea* along Broadway (South) (E.W.G.); vii-ix, not uncommon on *Salix fragilis* (D.C.).

Idiocerus tremulae (Estlund) – x.1969, locally on aspen *Populus tremula* (D.C.).

Idiocerus vitreus (Fab.) – vii-ix, common on Lombardy poplar *Populus nigra* 'Italica' (D.C.).

Idiocerus vittifrons Kb. – ix.1964, x.1966, ix,x.1967, sparsely on field maple *Acer campestre* (D.C.).

Iassus lanio (L.) – 9.x.1955, beating *Quercus robur* along Broadway (South) (E.W.G.); vii-ix, common on oak (D.C.).

Oncopis flavicollis (L.) – 9.vi.1934, on birch, common (F.J.C.).

Macropsis cerea (Germar) – vii-viii, common on sallows (D.C.).

Macropsis glandacea Fieb. – 9.ix.1951, on elm *Ulmus procera* (W.J.LeQ.).

Macropsis prasina (Boh.) – 15.viii.1964, on sallows (D.C.).

Macropsis scotti Edw. – 9.ix.1951 (W.J.LeQ.).

Macropsis scutellata (Boh.) – 9.ix.1951, on elm *Ulmus procera* (but probably accidental as normal food plant is nettle *Urtica dioica*) (W.J.LeQ.).

Agallia consobrina Curtis – 18.viii.1962, once only on sallow (D.C.).

Aphrodes bicinctus (Schr.) – 14.vi.1953 and 13.ix.1956, sweeping in a dry grass area, Eastern Plain (E.W.G.); 8.ix.1953, sweeping a damp grass area, I.O.W. Plain (E.W.G.); 12.viii.1956, by sweeping along the side of Common Road South towards the railway bridge (E.W.G.); vii-x, common (D.C.).

Aphrodes flavostriatus (Donovan) – viii.1968, swept once only, but quite probably common at grass roots (D.C.).

Doratura stylata (Boh.) – vii-x, common amongst grasses, feeds on *Dactylis glomerata inter alia* (D.C.).

Deltocephalus pulicaris (Fall.) – 9.vi.1934 (FJC); viii, ix.1964, not uncommon (D.C.).

Adarrus ocellaris (Fall.) – 9.ix.1951, (W.J.LeQ); 8.vii.1956, sweeping by Little I.O.W. (E.W.G.); 13.ix.1956, sweeping in dry grass area, Eastern Plain (E.W.G.); vi-x, abundant (D.C.).

Diplocolenus abdominalis (Fab.) ssp. *juvencus* (Hardy) – viii.1964, not uncommon (D.C.).

Arthaldeus pascuellus (Fall.) – vi-ix, abundant (D.C.).

Rhytistylus proceps (K.B.) – vii-x, not uncommon (D.C.).

Graphocraerus ventralis (Fall.) – vi-viii, locally common on grasses (D.C.).

Allygus commutatus (Fieb.) – 8.vii.1956, sweeping rank herbage in Eastern Hollow (see note on p. 152) (E.W.G.); vii.1966, from oak scrub (D.C.).

Allygus mixtus (Fab.) – 9.ix.1951 (W.J.LeQ.); vii-x, immature stages on grasses, common; imagines usually in shrubs (D.C.).

Allygus modestus Scott – vi-x, common, habits seemingly like those of *A. mixtus* (D.C.).

Conosanus obsoletus (Kb.) – 13.ix.1956, sweeping dry grass area, Eastern Plain (E.W.G.).

Streptanus sordidus (Zett.) – x.1969, not uncommon (D.C.).

Macustus grisescens (Zett.) – 8.vii.1956, sweeping rank herbage in Eastern Hollow (see note on p. 152) (E.W.G.).

Paluda adumbrata (Sahlb.) – viii.1964, local and not common, appears to favour a fine-leaved grass in drier areas (D.C.).

Paluda flaveola (Boh.) – 13.ix.1956, sweeping in dry grass area, Eastern Plain (E.W.G.); viii.1963, vii.1964 and vii.1966, local usually in shadier areas (edges of woodlands) (D.C.).

Hardya melanopsis (Hardy) – 9.ix.1951, a single male (W.J.LeQ.); iv-viii,x, locally abundant on grasses (D.C.).

Mocydia crocea (H.-S.) – iii-x, common (D.C.).

Thamnotettix confinis (Zett.) – vi-ix, not infrequent (D.C.).

Speudotettix subfusculus (Fall.) – v-vii, fairly common, usually on oak (D.C.).

Cicadula aurantipes (Edw.) – viii.1962, viii,ix.1964, in small colonies in wet areas (D.C.).

Cicadula quadrinotata (Fab.) – ix.1964 and ix.1967, not uncommon especially in damp areas (D.C.).

Elymana sulphurella (Zett.) – 9.ix.1951 (W.J.LeQ.); viii.1962, not infrequent (D.C.).

Soronius dahlbomi (Zett.) – vi.1965 and vi,vii.1966, a strong but very localised colony was found at Bookham (D.C.). [Le Quesne (1969) gives *Epilobium angustifolium* as one of its plant associates, and as this plant occurs frequently in open spaces on the Common, both in the woodland and on the plains, it should be possible to find further colonies – E.W.G.].

Balclutha punctata (Thunb.) – 9.ix.1951 (W.J.LeQ.); v-vi,viii-ix, common (D.C.).

Alebra albostriella (Fall.) – 9.x.1955, beating *Quercus robur* by path through S.E. Wood from the station to the railway bridge (E.W.G.).

Kybos butleri (Edw.) – 16.x.1955, sweeping sallow along Tunnel Path (E.W.G.).

Kybos populi (Edw.) – 9.ix.1951, on white poplar *Populus alba* (W.J.LeQ.).

Dikraneura variata Hardy – ix.1964, widespread (D.C.).

Eupteryx aurata (L.) – v-x, common on nettle and mint *Mentha aquatica* (D.C.).

Eupteryx signatipennis (Boh.) – vii.1966 and ix.1967, in colonies on meadowsweet *Filipendula ulmaria* (D.C.).

Eupteryx urticae (Fab.) – vii.1966, in colonies on stinging nettle (D.C.).

Eupteryx vittata (L.) – vi.1965 and vii,ix.1967, occasional (D.C.).

Ribautiana ulmi (L.) – vii,ix, common on elm *Ulmus procera* (D.C.).

Linnavuoriana sexmaculata (Hardy) – viii.1963 and v.1964, widespread on sallows (D.C.).

Edwardsiana hippocastani (Edw.) – x,xi.1969, common on elm *Ulmus procera* (D.C.).

Edwardsiana ishidai (Mats.) – taken on the Common in x.1969 on elm *Ulmus procera*, but not recognised as a British species until 1980 (D.C.).

Edwardsiana lethierryi (Edw.) – x.1966, on field maple *Acer campestre*, but not abundantly (D.C.).

Zyginidia scutellaris (H.-S.) – viii,ix.1964 and vi.1966, fairly common in grass (D.C.).

Arboridia parvula (Boh.) – 9.ix.1951, two females probably this species (W.J.LeQ.); ix.1964 and v.1966, common in grass (D.C.).

Zygina flammigera (Geoff. in Fourc.) – vii-iii (overwintering as adult), common (D.C.).

FULGOROMORPHA

CIXIIDAE

Tachycixius pilosus (Olivier) – v-viii, common in colonies (D.C.).

Cixius distinguendus (Kb.) – viii.1963, seemingly not common (D.C.).

Cixius nervosus (L.) – v-x, widespread and not uncommon, but never in numbers (D.C.).

Cixius similis Kb. – 21.vi.1955, beating aspen *Populus tremula* and silver birch *Betula pendula*, eastern end of Eastern Plain near Tunnel Path (E.W.G.); v,vi, locally abundant on wet ground (D.C.).

DELPHACIDAE

Stenocranus minutus (Fieb.) – ix.1964 and v.1966, common in grasses (D.C.).

Conomelus anceps (Germar) – 9.ix.1951 (W.J.LeQ.); viii-x, swarms on rushes (D.C.).

Delphacinus mesomelas (Boh.) – vii.1964, recorded once only, but no reason to assume it is uncommon (D.C.).

Ditropis pteridis (Spin.) – 9.vi.1934, on bracken *Pteridium aquilinum*, common (F.J.C.); vi.1965 and vi.1968, fairly common on bracken (D.C.).

Stiroma bicarinatus (H.-S.) – vi.1965 and vi,vii.1966, seemingly uncommon (D.C.).

Criomerus albomarginatus Curtis – v-vii,ix, common (D.C.).

Criomorphus williamsi China – v,1964, vi.1965 and vi.1968, on marshy ground near pond (D.C.) [presumably I.O.W. Pond – E.W.G.].

Dicranotropis hamata (Boh.) – 8.vii.1956, sweeping rank herbage in Western Hollow (see note on p. 152) (E.W.G.); v-vi, viii-ix, common in grasses (D.C.).

Muellerianella brevipennis (Boh.) – 9.ix.1951 (W.J.LeQ.); x.1969, taken on one occasion only (D.C.).

Hyledelphax elegantulus (Boh.) – iv-viii, common (D.C.).

Javesella obscurella (Boh.) – ix.1963 and iv.1966, in grass near pond (D.C.) [presumably I.O.W. Pond – E.W.G.].
Acanthodelphax denticauda (Boh.) – vi.1965 and v.1966, a strong colony in grass (D.C.).
Struebingianella dalei (Scott) – iv.1966, taken on one occasion only (D.C.).

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Note

In the summer of 1977 the stream running through the damp Eastern and Western Hollows, connecting the flow of water from Lower Eastern Pond with that of the Isle of Wight Pond, dried up completely. It was then considered an appropriate time to re-instate these hollows as ponds, which they had been in monastic times, artificially stocked with fish for Chertsey Abbey. The invasive willows, birches and other shrubs were grubbed up and a shallow depth of soil dug out from the floor of each hollow. At the onset of autumn rains of that same year the hollows began filling once again and have remained as ponds since that time.

Book Review

Wild Plants of Glasgow. Conservation in the City and Countryside. By J. H. Dickson. Aberdeen University Press. 1991. 208 pp. £14.95. ISBN 0 08 041200 9.

We received the review copy of this book, which was published on the 18 October, just as our page-proofs were being corrected for return to the printer. In the time available it has not been possible to review it in detail, but it is felt that the opportunity should be taken to bring it to our readers' attention. Therefore I will quote direct from the dust-jacket.

'Glasgow's waste ground and rubbish dumps, railway and motorway embankments, cemeteries and churchyards, canal and riverbanks, golf courses, woodlands and gardens support a wealth of wild flowers, some of them extremely rare. *Wild Plants of Glasgow* deals with the distribution and ecology of many of the 1100 wild plants that grow in the City of Glasgow and its surroundings, ranging from the commonest and most familiar to an orchid which may be claimed as Scotland's rarest plant. Many of these plants are illustrated in the book with colour photographs by Norman Tait and over 20 full colour plates specially painted by botanical artist Elspeth Harrigan.

'Large cities and their environs have increasing importance in plant conservation, and Glasgow has outstandingly good examples of urban and nearby rural habitats. However, these habitats are not peculiar to Glasgow and the issues raised in this book have direct implications for many cities in Britain and Northern Europe.'

The book is extremely well produced and will, I am sure, appeal widely to botanists and general naturalists, especially those living in or near to cities.

K. H. Hyatt

Botanical Records for 1990

By Rodney M. Burton*

Summary

Records for 1990 of vascular plants in the London Area are used as examples to illustrate the criteria by which records are shown for inclusion in papers such as these. Records from outside the Area are normally excluded, as are those which have already been published elsewhere, those which refer to deliberately introduced populations and those relating to plants of uncertain identification. It is usual to omit reports of the disappearance of species due to the destruction of their habitat or for other reasons, so the cumulative effect of publishing new discoveries is to give a false impression of constantly increasing botanical richness. In addition to their rarity, reasons why the records of certain species are more likely to be mentioned are their rediscovery in localities where they were known long before, the implication of important semi-natural habitat surviving, the information contained in the record about the species' status or its rate of increase, and the need to mention a survey carried out.

1. Arrangement of this paper

Although this paper is a successor to others by the same author since 1976, and before that by J. E. Lousley since 1945, the geographical arrangement of its predecessors is being forsaken this year in favour of an explanation of the criteria for inclusion of records. Those records which do get mentioned will be listed summarily in the usual geographical sequence at the end, referring to the paragraphs which are numbered for the purpose.

2. Marginal localities

Many more records are received each year and entered on the cards described by Burton (1984) in the paper following publication of *Flora of the London Area* (Burton 1983) than get published here. The writer has to form an opinion on which data are most likely to be of value after they have appeared in print, and of immediate interest to the reader. When a record is of marginal value, secondary criteria may decide for or against its inclusion. Being marginal in the geographical sense is an obvious example. Whether the boundary of the London Natural History Society's recording area is taken literally as a circle of 20-miles radius centred upon St Paul's Cathedral or the assemblage of rectangles used instead, which are at least easier to trace on a map, there will always be localities which are awkwardly placed across the boundary. When selecting from long lists of records of aliens supplied by John Palmer, I have always excluded those from New Ash Green, which is almost entirely outside the boundary, however defined. On the other hand, Ken Page's report of about 500 plants of greater yellow-rattle *Rhinanthus serotinus* from a part of Box Hill which is certainly just outside the area is judged more likely to interest members, as it does myself, confirming information which has not I think been previously published, though in 1984 Francis Rose told me he had long known this speciality of the east Surrey chalk in the same locality.

3. Previous publication

Previous publication, it may be inferred, is another possible reason for exclusion of a record. However it is not so clearly defined a reason as might be assumed. *B.S.B.I. News* is not sold to the public at large, but is distributed to members of the Botanical Society of the British Isles, some of whom are institutions like the L.N.H.S., who want the publications of the national societies for their libraries; does an item in *B.S.B.I. News* make repetition in *The London Naturalist* unnecessary? In the past I have been taken to task by the editor for assuming so, and will therefore mention now abundantly naturalised *Iris spuria* subsp. *ochroleuca* around Springhead and Northfleet (Palmer 1990).

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*Sparepenny Cottage, Sparepenny Lane, Eynsford, Kent DA4 0JJ.

4. Wildness

In this case there is no reason to doubt that the plant in question is wild enough to be worth mentioning. If this is in doubt, the record should be omitted. Last year (Burton 1990: 143) I unwisely mentioned a 'curious assortment of species in the churchyard of Holy Trinity, Brompton' which David McClintock has since pointed out to me were all planted. Deliberate introductions can be worth mentioning if there is any likelihood of subsequent misinterpretation, but I do not think this is likely in the case of the 16 native species of which a total of nearly 9,000 individuals were planted in Hyde Park in December 1989 and January 1990; Elinor Wiltshire told me that *Trifolium ochroleucon* was particularly successful.

5. Accuracy of identification

Any doubt about the correctness of the identification supplied is another reason for omission of a record. Even so the most experienced of botanists (including the writer) are capable of mistakes, and Eric Clement has asked me to point out that the *Vicia cassubica* reported here (Burton 1986: 197) was a wrong determination of the very variable *V. villosa*. The error is the result of published descriptions stating that *V. cassubica* has yellow pods, when in fact they are brown.

6. Problems of nomenclature

Other records have to be omitted because it is not known at the time what the plant should be called. Most often this arises in the case of aliens of unknown origin, which are recognisable, but cannot be named without a lot of research. These are the best cases where it is worth publishing a record long after it is made; in normal circumstances, the secondary criterion of lateness will favour leaving the record unpublished. Even with plants whose identity is reasonably clear the correct name may not be, but it is not generally worth publishing a correction on nomenclatural grounds alone, when the original context made clear what plant was meant. However I think it should be stated that the hybrid which a year ago (Burton 1990: 142) I said should be called *Cardamine* × *keckii* in preference to *C.* × *haussknechtii* should probably be called *C.* × *fringsii* Wirtgen (1899) in preference to *C.* × *haussknechtiana* O. E. Schulz (1903). This mis-spelling of the latter name was my mistake, the mis-application of the name *C.* × *keckii* was not.

7. Apparent loss of a plant

A different class of record which does not normally get published, though the observation needs to be noted, is a reported absence of a plant where it formerly grew. In the worst case this is the result of deliberate theft. In autumn 1990 what was believed to be the sole surviving plant of hard fern *Blechnum spicant* in Middlesex was dug up from the site on the margin of Harrow Weald Common where it was well known to many of our members, and the same fate befell a solitary plant of it on Hampstead Heath in 1949. More often a loss is the result of building development. In the spring of 1990 I visited a site at Darenth where I could once see many thousands of plants of whitlow-grass *Erophila verna* and found it cleared for building. More careful attention to detail is needed when the loss is perhaps attributable to changes in the habitat. A rare spike-rush *Eleocharis acicularis* used to occur fairly regularly at the edge of Aldenham Reservoir, and the last record I know of it there was in 1975; it has not been seen there in recent years, probably because the water-level is now maintained throughout the summer for recreational use. *Carex tomentosa*, a rare sedge, grew on Chertsey Mead until the site was sprayed and re-seeded, soon after I saw it there myself in 1970 (David 1983). However many of the other characteristic plants of the Mead have survived, and are listed in an unpublished flora by Barry Phillips and Robin Day, but when I went over the ground with them in May 1990 this rare sedge was quite clearly absent. The soil surface was already extremely dry, and 1990 may well prove to be the year which finished off many of our relict rarities of wet ground, such as flat-headed sedge *Blysmus compressus* at Foots Cray Meadows, last confirmed in 1985. Some can withstand drought alone, but not the consequent invasion of their habitat by more drought-tolerant species such as shading shrubs; the loss in this way of marsh violet *Viola palustris* from Reigate Heath was mentioned in our *Newsletter* No. 104 in 1990. There is not always any habitat change to explain the disappearance of a species. There is no obvious reason why brambles should not be plentiful along the surviving southern part of Gravelpit Lane at Eltham, but in fact there is none, and certainly not *Rubus spadix,* which has apparently not been seen again since it was described in this journal from two parts of this lane by Watson (1952). A couple of miles to the southwest is the locality where in 1979 Alan Willmott found sawwort *Serratula tinctoria* (Burton 1980); it still looks very suitable, though the bushes may have grown a bit, but had no trace of the plant in 1990.

8. Other aspects of loss of species

Care must be taken when reporting the apparent loss of a plant not to be confused by the normal fluctuation of species. Though sawwort localities in eastern England are few, it is constant in the others, whereas some species have a reputation of uncertain appearance. It is not a matter of great concern to me that the fiddle dock *Rumex pulcher* found at Horton Kirby on our meeting of 4 July 1987, when Steve O'Donnell sat next to it, could not be found again in the identical spot on 7 July 1990. Nor am I surprised that the small teasel *Dipsacus pilosus* which appeared at Lullingstone in 1989 (Burton 1990) after an interval of about a century (Hanbury and Marshall 1899) did not reappear in 1990. It would not be wise to look for such species in places where they have been reported here as growing, whereas other records appear to offer greater hope of a permanent increase in the flora. One general reason why plant records should have wide dissemination is that an appreciation of what is present in a locality thereby becomes more widespread. Many of the important losses which occur do not get reported, and any impression gained from reading a succession of accounts of additions to knowledge of the flora will inevitably be false.

9. Rediscovery of long-lost locality

This leads me on to what I find the most compelling secondary criterion in favour of publishing of a record (the primary criterion being the rarity of the species). It is a great thrill to be able to report the rediscovery of a plant which had been long believed lost: 1990 produced an excellent example. In what appears to be the locality described by Turner and Dillwyn (1805), presumably in the words of the finder Mr J. Woods, jun., as Down Barn Hill, near Harrow, Ian Johnson found green hellebore *Helleborus viridis* in good quantity. A less remarkable, but still pleasing, case is the rediscovery by Pippa Hyde of a rare cudweed *Filago minima* after about 40 years in Bushy Park.

10. Survival of the habitat: ancient woodland

In the case of the hellebore the locality is clearly unlike those places where the plant might be considered native. Quite a different criterion for inclusion is the record of a plant which indicates the survival of a natural habitat. There is a substantial literature (*e.g.* Peterken 1974) nominating indicators of ancient woodland. These can be either trees or elements of the ground flora. Representatives of the former category among Anthony Vaughan's 1990 observations are the Midland hawthorn *Crataegus laevigata* scattered in the wooded parts of Grovelands Park, which incorporates part of the former Winchmore Hill woods, service *Sorbus torminalis* in Big Wood, Hampstead Garden Suburb and old trees of durmast oak *Quercus petraea* in large gardens of Bishop's Avenue, N2, relics of Bishop's Wood as described by Tansley (1913), the survival of which was previously pointed out by Silvertown (1978). Silvertown's paper also dealt with Coldfall Wood and Queen's Wood. David

Bevan found small populations of *Hypericum pulchrum* surviving in both, and in Coldfall Wood heath speedwell *Veronica officinalis*. From Queen's Wood, he reports single plants of great woodrush *Luzula sylvatica* and broad-leaved helleborine *Epipactis helleborine* and two widely separated plants of tutsan *Hypericum androsaemum*. I am satisfied that the woodrush is an indicator of ancient woodland, but there have to be doubts about the others. The helleborine has appeared recently in some localities which have no woodland history, and uniquely among European orchids has become an invasive alien in North America (Scoggan 1978: 532). Tutsan sometimes appears as a result of fruit having been taken from plants in gardens by birds who mistake them for berries. Ancient woodland plants I found myself in 1990 include goldilocks *Ranunculus auricomus* in Bexley Park Wood; this was among a number of species in the wood confined to the smaller northern part, which is largely cut off from the heavily trampled remainder by the River Shuttle.

11. Other habitats

As well as woodland habitats, the survival of which is indicated by 1990 records received, are acid grassland, neutral grassland and a variety of wet habitats. As acid grassland relics, I will mention first wild clary *Salvia verbenaca* in an old lawn in Chiswick and nearby a rare chickweed *Stellaria pallida* and meadow saxifrage *Saxifraga granulata* in Chiswick Park, all seen by John Latham. The saxifrage was also found on Laleham Burway Golf Course by Barry Phillips and I found a few plants in the meadow opposite Franks, Horton Kirby, a more neutral site from which it had been feared lost. The rarer native flora of acid grassland includes a higher proportion of vernal annual species than other habitats, such as upright chickweed *Moenchia erecta* found in Jubilee Park, Petts Wood by Joyce Pitt, whose populations fluctuate according to the year's weather. In 1990 they dried up quickly, and later in the year the drought made the persistence of chamomiles *Chamaemelum nobile*, a perennial species, on the Reigate Heath cricket field more obvious when our meeting of 15 July walked over it. A different strategy for dealing with possible summer drought is adopted by adder's tongue *Ophioglossum vulgatum* which dies back to buried rhizomes in summer; though perhaps more often in neutral grassland, it was in a decidedly acid environment where Sue Swales found it near the ruin of Shornell's on Bostall Heath. More consistently neutral grassland species are strawberry clover *Trifolium fragiferum*, which Ron Parker reported from a suburban roadside in North Cheam, and corn caraway *Petroselinum segetum*, found on Rainham Marshes by our meeting of 1 September. The wet habitats to be mentioned are a ditch on Addlestone Moor which Barry Phillips found full of water-violet *Hottonia palustris* and the floor of a chalk-pit at Swanscombe, the last remaining habitat of the marsh helleborine *Epipactis palustris* in West Kent, where Mr Palmer was able to report it still extant on 8 July, although the pit is being filled with rubbish. The Epping Forest locality for the marsh cinquefoil *Potentilla palustris*, where the plant was confirmed by our Ramblers Section on 2 June, may also be in this category, but the plant has been known there only since 1933 and may be a deliberate introduction.

12. Bearing on natural history of species

Other records are of interest, over and above the rarity of the species concerned, not for what they say about the habitat, but for their bearing on the status or on some aspect of the natural history of the species. In London this most often relates to the speed of increase of alien species. The duckweed *Lemna minuscula* was first reported in the London Area at Harlow in 1978 (Leslie and Walters 1983); new records are now so frequent and well scattered that they are not worth separate mention. Five years ago (Burton 1986: 194) I published a map of the recorded distribution of *Conyza sumatrensis* in the London Area; this larger relative of the Canadian fleabane was then mostly to be found in an area about 7 km across centred on the East End of London. Observations in 1990 were particularly numerous and show that it has increased to become fairly continuously distributed in an area about 12 km across extending south of the Thames and east of the Lea. In Kent it has also appeared in a few isolated localities which lost their trees in the storm of 16 October 1987; one of these, north of Westerham, was found independently by Geoffrey Kitchener and myself. This is a species to be looked out for in all parts of the London Area so that its spread can be monitored; brief descriptions can be found in Marshall (1973, as *C. floribunda*) and Burton (1985: 114). The increase implied in a discovery can also be in the size of a single clone, and the information imparted will then relate to its growth rate. The stand of Bermuda grass *Cynodon dactylon* found on the Northern Outfall embankment near Dace Road, Hackney Wick at our meeting of 29 July covered several square yards of ground which had been devastated by fire a couple of years before. The colony of *Duchesnea indica* found by David Bevan in Queen's Wood must also be quite new, but already measures about 3m^2. Rare native species cannot be expected to show measurable increases in the same way, but even so it is worth mentioning Ron Parker's report of the extension westward of tall broomrape *Orobanche elatior* and greater yellow rattle *Rhinanthus serotinus* into the London Borough of Sutton portion of the Croydon Airport site. Other alien species which do not spread are more likely to be mentioned if their records contain some information about how well they persist. *Vitis coignetiae* and *Coronilla emerus* found by Mr Palmer on roadsides at Hextable in 1982-83 would not have been thought of much interest immediately, but they were still there in 1990, as was London rocket *Sisymbrium irio* which unlike the other two cannot have been of garden origin and was thought worth publishing by Mr Palmer himself at the time (Palmer 1983). A rather different case is that of the yellow bartsia *Parentucellia viscosa*, which in the London Area has a history of appearing occasionally, with wide separations of space and time, persisting a few years and then disappearing. I found a group of about 30 fruiting plants of this in late July in a field in Pippenhall Pastures, Eltham, where it would hardly have been overlooked if present when the area was surveyed by Jeff Edwards in June 1985 for the London Wildlife Trust. I think a common factor in many of the London occurrences of the plant, which is native and locally abundant in many localities in Cornwall (Margetts and David 1981: 226), may be the transport of hay as horse-feed.

13. Surveys: the London Wildlife Survey

The opportunity to mention a site survey is itself a reason for including a record. Although only the most outstanding individual species are likely to get named here, the fact that a site has been surveyed and a more comprehensive account of its vegetation and perhaps other aspects of its natural history prepared, though not necessarily published, is considered likely to be of interest. In London consideration of such surveys must begin with the London Wildlife Survey carried out under contract to the Greater London Council in 1984-85. The object of this was to identify all sites above a certain minimum size which could be considered to have any nature conservation value and grade them according to their quality, the highest grade being a site of metropolitan importance. Many of the sites were visited only once, not always at the most appropriate time of year, so the surveys are of unequal value as accounts of individual sites. The results of the grading are being published a borough at a time in a series called *Ecology Handbooks* by the London Ecology Unit, which is financed by the London boroughs to continue the work of the G.L.C. Ecology Unit. The original London Wildlife Survey is now some years old and it is increasingly necessary for the L.E.U. to check and improve their data. *Ecology Handbook* No. 4 (Greater London Council 1986) was very enthusiastic about the Limmo Peninsula in East London, which will have to be described very differently in *Nature Conservation in Newham*, a *Handbook* to be published in 1991, having been largely stripped of its vegetation in 1990. I imagine it was in the course of an update of the data for Sutton that John Archer visited waste ground near Therapia Lane and the railway from which he sent me a very long list, including dittander *Lepidium latifolium*, field scabious *Knautia arvensis*, rest-harrow *Ononis repens*, vervain *Verbena officinalis*, viper's bugloss *Echium vulgare*, one plant of sickle medick *Medicago falcata* and others of its hybrid *M.* × *varia* and one yellow vetchling *Lathyrus aphaca*. It is hard to imagine what can have been the history of a site with such an assemblage.

14. Hertfordshire flora survey

A comprehensive survey of a very different kind is that currently under way in Hertfordshire. Volunteers, some of them members of the London Natural History Society, have for a few years already been collecting records which can be expected to appear in a publication which will in many ways supersede Dony (1967). Participants in the survey are invited to record from localities rather than map-squares, although the distribution of the commoner species will be illustrated by dot-maps to allow historical comparison with those of Dony. The layout of the recording forms supplied to them encourages the contribution of full detail of the locality, abundance and habitat of the rarer species. By the kindness of Trevor James at the county Environmental Records Centre (Bury Mead Road, Hitchin SG5 1RT), who is co-ordinating the survey and would certainly welcome more volunteers, I have been able to see all these observations made within the L.N.H.S. recording area up to 1990, and very interesting they are too. To reveal too many of them now would unfairly anticipate his own publication, but I must at least mention a few, selected according to the criteria mentioned elsewhere in this paper. Near Elbow Lane Mr James and Ann Boucher found quaking-grass *Briza media*, dyer's greenweed *Genista tinctoria*, pepper saxifrage *Silaum silaus*, betony *Stachys officinalis* and the grass *Bromus commutatus* which together indicate unimproved meadow-land, a habitat now very hard to find. On rough ground near Cheshunt Station Mrs Boucher collected what appears to be the first Herts specimen of *Bromus madritensis*, which I see was identified for her by myself. The now rare aquatics *Potamogeton friesii* and *Ranunculus circinatus* were both found in the Lea Valley by Mr James, and the latter was also seen near Rickmansworth by Peter Ellison. N. Willcox found betony and lady's mantle *Alchemilla vestita* in pasture east of Colney Heath. These are all 1990 records, but in 1989 Barry Tranter found a single plant of maiden pink *Dianthus deltoides* on gravel at Smallford, Mr James with the British Fern Society found two stems of wood horse-tail *Equisetum sylvaticum* in a corner of Ball's Wood and Ian Marshall found a clump of hard fern *Blechnum spicant* in Bishop's Wood, and in 1988 Joan Foster reported a small quantity of opposite-leaved pondweed *Groenlandia densa* in the River Ver, David Marshall found mat-grass *Nardus stricta* near Sleapshyde gravel-pit and Mrs Boucher found four patches of the rarer form of hoary cress *Cardaria draba* subsp. *chalepensis* by the railway at Hertford. However no-one finds wall whitlow-grass *Draba muralis* at Loudwater any more.

15. Other site surveys

The last two paragraphs both represent surveys rather different in character from the single-site investigation which occurs more commonly. An example is the Kenwood landscape survey, conducted for English Heritage by the Colson Stone Partnership. Whilst their report quite correctly draws attention to the value of the remaining bog, the species mentioned here must be *Blechnum spicant* and great wood-rush *Luzula sylvatica* observed where they had become exposed to view on the stumps of windthrown trees. The former is therefore not quite extinct yet in Middlesex after all. A rather larger area was covered by the survey Jo Weightman and Ishpi Blatchley carried out for the National Rivers Authority, examining the flora, especially the aquatic flora, which was looked at in great detail, of Erith and Crayford Marshes. Mrs Pitt and I joined them north of Belvedere on 22 July, and we were very pleased to see that many uncommon species still persist well on the marshes, such as knotted bur-parsley *Torilis nodosa*, corn caraway *Petroselinum segetum*, lesser water-parsnip *Berula erecta*, strawberry clover *Trifolium fragiferum*, least pondweed *Potamogeton pusillus*, the identification of which was subsequently confirmed by Nigel Holmes, and enormous numbers of the marsh dock *Rumex palustris*. On Crayford Marshes the two ladies were very pleased to find marsh arrow-grass *Triglochin palustris* in some plenty on, but not confined to, the edge of one dyke, and two species particularly associated with submaritime conditions and therefore, like the latter, rare in London, a water-crowfoot *Ranunculus baudotii* and brookweed *Samolus valerandi*. The latter was seen in a total of four places, and although it had a good year also outside the London Area, could not be refound in either of the places where it was seen in 1976-77 (Burton 1983: 111) and not again since.

16. Inner London localities

Amongst the records which do not have any of the positive criteria already mentioned, greatest prominence is often given here to those with Inner London locations, which are almost certain to be unexpected. One can hardly get more 'inner' than the pond in the City where John Montgomery found water fern *Azolla filiculoides*, but the status of that must be uncertain. Much more remarkable are the Danish scurvy-grass *Cochlearia danica* growing in two patches on railway ballast west of London Bridge, observed from trains, as they could only be, by Mr Kitchener, and the colony of mousetail *Myosurus minimus* in Hyde Park first noticed by Brian Wurzell. It is as difficult to suggest how it got there as it was a year before when the same species appeared in Brompton Cemetery. That the Hyde Park plants were all very small is probably due to drought; so too were the field pansy *Viola arvensis* and parsley piert *Aphanes arvensis* growing near them. In another part of the park Mrs Wiltshire found a much larger plant, the alien dock *Rumex patientia*. She also went to Brompton Cemetery, seeing no mousetail, but other interesting plants including blue fleabane *Erigeron acer*, hairy tare *Vicia hirsuta* and hoary willow-herb *Epilobium parviflorum*.

17. Other very urban localities

Although Inner London, with a capital I, is a defined area used for instance in the L.N.H.S. bird records, there is no clear boundary to the central area characterised by consisting mainly of commercial property with little residential occupation. It is the sort of surroundings in which a plant occurs rather than the precise distance of the locality from the centre of London which determines the degree to which the record is remarkable for the purposes of this paper. Mr Archer's hemp agrimony *Eupatorium cannabinum* in a derelict garden in Lewisham, Peter Holland's musk thistle *Carduus nutans* in a lawn in Acre Lane, Brixton, the woad *Isatis tinctoria* which I noticed self-sown near the demonstration garden for the disabled in Battersea Park, the *Gypsophila muralis* which Mrs Wiltshire found in a pavement crack in Kensington, Mr Bevan's marsh dock in a Finsbury Park flower-bed, the bramble *Rubus surreyanus* discovered by David Allen in a Regent's Park shrubbery and the plentiful fern grass *Catapodium rigidum* which I saw lining a street near The Angel, Islington are all examples of records which in any year would get a mention because of the unexpectedness of any unusual plant in distinctly urban surroundings, even though the localities may or may not be within the Inner London rectangle. (Conversely, a plant of Oxford ragwort which had turned up in the middle of the cornfield I can see from my window would also be worth a mention.)

18. Rural species in suburban surroundings

In the less central London boroughs, it is the chance occurrences of species more usually associated with more rural surroundings of one kind or another which are most likely to get reported. Many good examples were produced in 1990. Perhaps the best is the single plant of slender hare's-ear *Bupleurum* *tenuissimum* found by Mr Bevan on Tottenham Marsh. There is always the hope that publication of such a record where it is fairly widely read may prompt a reader with special knowledge of the species concerned to suggest how it might have got where it did. Orchids have a well-known fascination, and records like Alan Gibson's spotted orchid *Dactylorhiza fuchsii* near Alexandra Palace and G. Hansome's bee orchid *Ophrys apifera* in Coppett's Wood, respectively communicated and confirmed by Mr Bevan, are likely to get included, but in these cases it can be assumed that wide dispersal of the very light seeds on the wind accounts adequately for the isolated appearance of single plants. Broomrapes are dispersed in the same way, and include *Orobanche minor* found by Terry Lyle on the Isle of Dogs.

19. Plants of the Mottingham Nature Reserve

No accident of wind dispersal can explain the occurrence of toothwort *Lathraea squamaria* as a parasite of common lime by a brook near Mottingham, far from its typical habitat on the dip slope of the North Downs. This was first found by Bernard Bligh in 1989, but did not come to my notice until 1990. When I went to examine the site myself I found that nearby were marjoram *Origanum vulgare* and nettle-leaved bellflower *Campanula trachelium*. None of these can be considered native plants in this locality, nor can their presence be a consequence of the very recent establishment of this ground as a nature reserve. I have to assume that they are relics of the time when this was the edge of a private park, not a bit of ground left over at the back of a garden centre. Parking in front, I discovered strong plants of the hairy buttercup *Ranunculus sardous*, just as doubtfully native and just as rare in suburban Kent.

20. Other suburban sites

A variety of other plants of similar interest was found in 1990. Elizabeth Norman saw a dozen plants of golden dock *Rumex maritimus* in a dried-up basin of Barn Elms Reservoir; with it were one *Salvia verbenaca*, a large patch of sea club-rush *Scirpus maritimus* and plenty of bulrush *S. lacustris*. Mr Kitchener saw a large specimen of stinking hellebore *Helleborus foetidus* by the railway near Pett's Wood Station where it could not have been planted. Mrs Weightman told me about a small patch of maiden pink *Dianthus deltoides* on Chislehurst Common, which she learned about from John Belsey who lives near and has known it for 40 years. Roy Hurr found lady's tresses *Spiranthes spiralis* on his own front lawn at Chelsfield. Mr Vaughan found large flourishing patches of shining cranesbill *Geranium lucidum* in young secondary woodland, the site of former Crouch End Playing Fields, and fairly frequent slender soft-brome *Bromus lepidus* in two leys in Totteridge fields.

21. Unusual exotics

In the absence of any special feature of the circumstances or the place in which a plant was found, the only criterion favouring the mention of a record is the rarity of the taxon. Plants which are reported very seldom are mostly either exotics or hybrids. Mr Palmer found a plantation of small trees east of Swanley among which were many bird-seed aliens and common garden annuals, and also *Anthemis austriaca* not previously recorded from Britain. This and *Cyperus albostriatus* were determined by Eric Clement, as were *Artemisia pontica* on waste ground north of Swanley and *Trifolium alexandrinum* on a tip at Swanscombe. Other strange discoveries of Mr Palmer's were statice *Limonium sinuatum* on a tip at Stone and beard-grass *Polypogon monspeliensis* in quantity by Littlebrook lakes. The former has recently become a crop plant for the flower trade in Kent and can be expected to occur as a casual alien more often. The grass is a native plant in not dissimilar habitats further east in the Thames estuary, but in the absence of older records from Littlebrook I will assume that this discovery, like the rest of his mentioned here, is of an introduced plant. The same species together with a × *Triticosecale* and other plants were found on a pavement in North Cheam by Mr Parker. The latter, identified by Alan Leslie, is a series of fixed hybrids between wheat and rye available in commerce as 'triticale'. I have seen this as a field crop in the London Area but have no previous knowledge of it as a casual alien. Another first for our records is the alien sorrel *Rumex rugosus* found at Cheshunt by Mrs Boucher and identified for us by Mr Kent, who now prefers to call it *R. acetosa* subsp. *ambiguus*. The source of this can only be described as obscure. Very rare aliens of obviously garden origin are *Scilla bithynica* which David Nicolle found abundantly naturalised at St Mary Cray and *Lonicera henryi* which with *L. japonica* was seen by Julia Leslie, Ken Page and Joyce Smith to have spread to the margin of a playing field at Coombe Hill.

22. Unusual hybrids

Three hybrids found in 1990 must be mentioned. Our meeting of 29 September found the dewberry–raspberry cross *Rubus* × *idaeoides* on Walton Common. With a party of Wild Flower Society members on 8 July I found two clumps of the cross between our two water-plantains, *Alisma* × *rhicnocarpum*, in the Grand Union Canal near Cowley. A hybrid yellow-cress *Rorippa* × *armoracioides* already well known from Walthamstow Reservoirs was found on Tottenham Marsh by Mr Bevan, though later destroyed by roadworks; it could be part of the same clone, though its mode of travel from Walthamstow to Tottenham needs to be accounted for.

When all the different criteria mentioned are considered, it will be seen that many worthy records are likely to go unpublished. This is the inevitable consequence of lack of space. The area covered by these reports is a large one, well covered by active botanists. Whether published or not, however, all records received are added to the Society's store of knowledge about its higher plants, and will continue to be welcome.

Geographical Index

V.-C. 16, Greater London portion

Berula erecta (15), *Blysmus compressus* lost? (7), *Campanula trachelium* (19), *Dianthus deltoides* (20), *Eupatorium cannabinum* (17), *Helleborus foetidus* (20), *Lathraea squamaria* (19), *Moenchia erecta* (11), *Ophioglossum vulgatum* (11), *Origanum vulgare* (19), *Parentucellia viscosa* (12), *Petroselinum segetum* (15), *Potamogeton pusillus* (15), *Ranunculus auricomus* (10), *R. baudotii* (15), *R. sardous* (19), *Rubus spadix* lost (7), *Rumex palustris* (15), *Samolus valerandi* (15), *Scilla bithynica* (21), *Serratula tinctoria* lost (7), *Spiranthes spiralis* (20), *Torilis nodosa* (15), *Trifolium fragiferum* (15), *Triglochin palustris* (15).

V.-C. 16, Kent portion

Anthemis austriaca (21), *Artemisia pontica* (21), *Conyza sumatrensis* (12), *Coronilla emerus* (12), *Cyperus albostriatus* (21), *Dipsacus pilosus* lost? (8), *Epipactis palustris* (11), *Erophila verna* lost (7), *Iris spuria* subsp. *ochroleuca* (3), *Limonium sinuatum* (21), *Polypogon monspeliensis* (21), *Rumex pulcher* lost? (8), *Saxifraga granulata* (11), *Sisymbrium irio* (12), *Trifolium alexandrinum* (21), *Vitis coignetiae* (12).

V.-C. 17, Greater London

Carduus nutans (17), *Cochlearia danica* (16), *Conyza sumatrensis* (12), *Echium vulgare* (13), *Isatis tinctoria* (17), *Knautia arvensis* (13), *Lathyrus aphaca* (13), *Lepidium latifolium* (13), *Lonicera henryi* (21), *L. japonica* (21), *Medicago falcata* (13), *M.* × *varia* (13), *Ononis repens* (13), *Orobanche elatior* (12), *Polypogon monspeliensis* (21), *Rhinanthus serotinus* (12), *Rumex maritimus* (20), *Salvia verbenaca* (20), *Scirpus lacustris* (20), *S. maritimus* (20), *Trifolium fragiferum* (11), × *Triticosecale* (21), *Verbena officinalis* (13).

V.-C. 17, Surrey

Carex tomentosa lost (7), *Chamaemelum nobile* (11), *Hottonia palustris* (11), *Rhinanthus serotinus* (2), *Rubus* × *idaeoides* (22), *Saxifraga granulata* (11), *Viola palustris* lost (7).

V.-C. 18, Greater London

Conyza sumatrensis (12), *Petroselinum segetum* (11).

V.-C. 18, South Essex

Potentilla palustris (11).

V.-C. 19, North Essex
Nil.

V.-C. 20, Greater London
Bromus lepidus (20).

V.-C. 20, Herts
Alchemilla vestita (14), *Blechnum spicant* (14), *Briza media* (14), *Bromus commutatus* (14), *B. madritensis* (14), *Cardaria draba* subsp. *chalepensis* (14), *Dianthus deltoides* (14), *Draba muralis* lost? (14), *Eleocharis acicularis* lost? (7), *Equisetum sylvaticum* (14), *Genista tinctoria* (14), *Groenlandia densa* (14), *Nardus stricta* (14), *Potamogeton friesii* (14), *Ranunculus circinatus* (14), *Rumex rugosus* (21), *Silaum silaus* (14), *Stachys officinalis* (14).

V.-C. 21, Greater London
Alisma × rhicnocarpum (22), *Aphanes arvensis* (16), *Azolla filiculoides* (16), *Blechnum spicant* lost (7) and found (15), *Bupleurum tenuissimum* (18), *Cardamine flexuosa × pratensis* (6), *Catapodium rigidum* (17), *Crataegus laevigata* (10), *Cynodon dactylon* (12), *Dactylorhiza fuchsii* (18), *Duchesnea indica* (12), *Epilobium parviflorum* (16), *Epipactis helleborine* (10), *Erigeron acer* (16), *Filago minima* (9), *Geranium lucidum* (20), *Gypsophila muralis* (17), *Helleborus viridis* (9), *Hypericum androsaemum* (10), *H. pulchrum* (10), *Luzula sylvatica* (10, 15), *Myosurus minimus* (16), *Ophrys apifera* (18), *Orobanche minor* (18), *Quercus petraea* (10), *Rorippa × armoracioides* (22), *Rubus surreyanus* (17), *Rumex patientia* (16), *Salvia verbenaca* (11), *Saxifraga granulata* (11), *Sorbus torminalis* (10), *Stellaria pallida* (11), *Trifolium ochroleucon*, etc. (4), *Veronica officinalis* (10), *Vicia cassubica* error (5), *V. hirsuta* (16), *Viola arvensis* (16).

V.-C. 21, Middlesex
Nil.

V.-C. 24, Bucks
Nil.

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Obituaries

HILDA FRANKS, 1890-1990

Hilda Franks died in May 1990, a month after reaching her hundredth birthday. She was born in Hucknall, Nottinghamshire, on 19 April 1890 and, at the age of thirteen, became a pupil-teacher of infants and juniors. She moved to London in 1919, first doing rehabilitation therapy with shell-shocked patients and then becoming a teacher specialising in natural history and biology, eventually retiring from full-time teaching in 1952 and then continuing in supply work.

She joined the L.N.H.S. in 1936 and in 1946 was appointed to the Society's newly created post of Schools' Liaison Officer, thus bringing the activities of the Society to the attention of teachers in the G.L.C. area. I am eternally grateful to her for such an introduction. She retired from the post in 1959, when it lapsed. From 1949-1951 she was Kent Representative on the Society's London Area Nature Conservation Committee. She was also very active in the Ramblers Section, holding in turn the offices of Secretary, Chairman and Committee member, as well as being their Lanternist for a number of years. In 1981 she was made an Honorary Member of the Society.

Miss Franks was energetic and enthusiastic and had many interests. For almost 50 years she was a Hostess for the Co-operative Holidays Association. She taught in Sunday School till she was 80 and at 88 went on holiday in India. Failing eyesight then restricted her activities, but she managed to complete her autobiography, *A Country Child of the 1890s*, which was published in 1987 by The Book Guild Ltd. Her life, indeed, was lived to the full and many people will remember her with affection.

MARGARET E. KENNEDY

ERIC HOSKING, O.B.E., HON.F.R.P.S., M.B.O.U., 1909-1991

Eric Hosking was a wildlife photographer of the highest calibre and was known the world over as *the* bird photographer. He became the first man to earn his living as a professional wildlife photographer, and his photographs have become legend, appearing in more than 1,000 books worldwide, as well as in numerous scientific reports and journals. He joined the L.N.H.S. in 1950 and immediately became actively involved with the Ornithology Section and our participation in the foundation of the Dungeness Bird Observatory. In 1959 he was made an Honorary Vice-President.

I gradually got to know him through discussing bird photography problems, usually at the conclusion of L.N.H.S. meetings held in London during the 1950s, and although he was often in the company of such stalwarts as Stanley Cramp and Dick Homes, he would give freely of his time in an enthusiastic and informative way, which made you feel that you were making progress.

He had no time at all for photographers who exploited their subjects and left the scene after getting their photographs; he was a person fully committed to the subjects' welfare. Most of us have read how he left school with the headmaster's remarks ringing in his ears 'You'll never make anything of your life Hosking'. Perhaps, somehow, this ill-founded remark was one of the spurs that young Eric needed to get out and succeed in life, although natural history had been his one compelling interest as early as he could remember, and photographing it began at the age of eight. During the ensuing years he seriously injured his left foot, became unemployed in 1929 when the firm he worked for went bankrupt and lost the sight of his left eye to a female tawny owl in 1937. However, at 22 years of age, Eric was lucky to get a break from a friend who was the sub-editor of the *Sunday Dispatch*, and he was commissioned to

Top. Eric Hosking, 1987. *Photo: David Hosking.*

Bottom. Tawny owl *Strix aluco*. The female that robbed Eric Hosking of his left eye in 1937 was photographed in April 1938, one year after the attack. *Photo: Eric Hosking.*

photograph a baby elephant seal at London Zoo, an assignment which earned him two guineas and set him firmly on the path he was to follow for so many years. Whether we know it or not, we have all seen a Hosking bird photograph at some time during our lives; the swan on the 'Swan Vestas' matchbox was taken from one of his photographs, as was the Montagu's harrier, which formed the insignia of a famous R.A.F. Squadron. He was an acute observer and photographer of all forms of wildlife, not just birds, and was a pioneer in several photographic techniques.

Eric's high-speed flash photograph of the barn owl in heraldic pose is probably the most famous photograph he ever took, being reproduced in over 100 countries and yet, for me, his shot of a hovering nightjar takes an awful lot of beating for sheer skill and technical application, which has resulted in a really superb photograph that cannot be bettered today. For those of us who savour the delights of watching birds at close quarters from a hide, the endurance necessary to remain motionless for long periods of time is extremely difficult to achieve, and yet Eric had this attribute in abundance. His ability to remain still in a small hide for hour after hour during the day, and sometimes most of the night, was legendary.

In the course of some 60 years' work, covering nearly 2,000 species from snowy owls in Shetland to the shy kiwis in New Zealand, Eric's photographs show not only commensurate photographic skill, but a unique sense of timing, a knowledge of exactly when to press the shutter. I remember how, with great excitement, I jostled with the crowds to see Eric's work 'Looking at Birds', at the Kodak Gallery in Kingsway in 1957, and his one-man shows 'An Eye for a Bird' in 1980, and 'Arctic Wildlife' in 1982; these are remembered avidly. In 1979 The Brotherton Gallery in Chelsea staged a special exhibition to celebrate Eric's 'Fifty Years of Wildlife Photography'.

His courage in making wildlife photography his chosen profession was typical of the man, with his determination to succeed in pre-war years when public awareness of bird photography was pretty scant and bird photographs were difficult to sell. To supplement his income Eric undertook weddings, child photography and general-interest press photography, including one noteable assignment – the two daughters of the Duke and Duchess of York, Princess Elizabeth and Princess Margaret Rose: no sign of nerves here!

He was also an excellent lecturer on the subject of wildlife photography, and visited schools, clubs and natural history societies everywhere, and even spoke at the Trocadero Restaurant in 1938, showing slides to the assembled diners between other cabaret acts, something which must have taken quite a bit of courage!

He was more than fortunate to meet Dorothy Sleigh who became his wife, a lady who shared his enthusiastic love of nature to the point where she shared their honeymoon in Scotland with an assignment to photograph golden eagles at the nest!

Having used flash powder to photograph animals by night, and setting fire to the odd tree in the process, he became a pioneer user of Sashalite flash-bulbs to record birds at night, and his picture of a barn owl at the nest with prey, in 1936, became the first of many fine studies using this new technique.

Eric had visions of photographing birds in flight using the new electronic flash equipment that manufacturers like Dawe Instruments were producing for the Press to use, and with its intrinsically shorter flash duration than the Sashalite bulb, it certainly did the job. However, Eric wasn't satisfied, he wanted to go further. He enlisted the help of Dr Phillip Henry of the British Cotton Research Unit to design and build him a flash unit with two lamps that would give a 1/5,000th of a second flash duration, well able to arrest the action of most birds.

Mute swan *Cygnus olor* in London, 1931. *Photo: Eric Hosking.*

There was a snag however, the new technology wasn't miniaturized as today, the flash set weighed in at over a hundredweight, and the battery to drive it all, a mere 40lbs! To capture birds in flight at a predetermined spot requires that your camera be focused on that spot in advance and fired, so Eric asked Dr Henry to design and build a trigger which would do just that. Dr Henry came up with a photo-electric cell that triggered the camera once a beam of light focussed on it was broken by a passing bird.

Bearing in mind the weight of the new flash equipment, and such imponderables as 'how far does the bird travel after the beam is broken, before the camera fires?', and the sheer hard work and ingenuity that went into those early high-speed flash shots, the quality of the resultant photographs is quite remarkable. One result from this new equipment was the famous 'heraldic pose' barn owl which has been Eric's trademark ever since. During the 1940s and 50s Eric was often heard on the radio in James Fisher's 'Birds in Britain' programme, contributing to many interesting and, sometimes, heated discussions on ornithology. After one particular programme Guy Mountfort, who had also participated, invited Eric to be responsible for all the photography on an expedition he was leading to the Coto Doñana in 1956. This turned out so successfully that Mountfort automatically asked Eric to accompany him on several other expeditions.

For the 1957 Coto Doñana expedition Eric decided that amongst other species he wished to record, the Spanish imperial eagle was a must and he somehow managed to arrange through Lord Alanbrooke, a member of the expedition, and through Lord Mountbatten and the Royal Navy, for several tons of tubular scaffolding to be sent from England, so that a large pylon hide could be built near the eagles' nest – no mean feat of logistics that!

Although he was indeed blessed with a great determination to succeed in his projects, he never lost sight of his main objective – the wellbeing of the species in front of his camera; he always put the subject first.

Amongst his many achievements Eric was a keen participant in judging photographic competitions and was involved in the original B.B.C. Wildlife competition in 1966, until 1984, when he became one of its presenters. During his many years of active work, he was awarded both his Associateship and Fellowship of the Royal Photographic Society in the same year, 1934, and his Honorary Fellowship in 1967, whilst in 1989 he was awarded the R.P.S. Premier Award of the Progress Medal, a prodigious achievement. He also received the

Long-eared owls *Asio otus*. Cock brings a young rat to the hen at midnight during the 1940s. *Photo: Eric Hosking.*

Nightjar *Caprimulgus europaeus*. Male hovering, 1949. Note how the further wing has been bent completely round so that the primaries are pointing forwards.
Photo: Eric Hosking.

Cherry Kearton Medal and Award from the Royal Geographical Society and in 1977 he was awarded the O.B.E. for his natural history photography and work in conservation. Apart from being an Honorary Vice-President of the L.N.H.S., Eric was also a Vice-President of the R.S.P.B., and found time for 56 years' membership of the Zoological Photographic club, becoming a council member and then President. He was also very involved in the publication of bird books, many illustrated with his own, and more recently, son David's, photographs, with such notable authors as Jim Flegg, R. M. Lockley, Bert Axell, Frank Lane and others, and one can see what a full and rewarding life he led. In 1945 he was appointed photographic editor to Collins' 'New Naturalist' series, and until his death was the sole surviving member of the original editorial team.

His whole life was given to birds, as he himself once said 'I'm so bird minded, I must be a bit of a bore, birds are my work seven days a week, not that it's work to me – it *is* my life'. A friend recalls him saying: 'If the day comes when I cannot hold and focus a camera, then I hope it will be my last day.'

His 80th birthday was celebrated in September 1989 by giving an autobiographical slide show at Cambridge, to the R.P.S. and his many friends. The talk enthralled everyone present and belied his age with its fluency and presentation, and more than that, it was done off the cuff, without a single reference note! Even up to a few days before his death in February 1991, Eric was actively photographing wildlife in Kenya with Dorothy and some friends, producing the quality shots he always did. His photographs over the years are a priceless legacy of wildlife seen through the lens of one man, who will be remembered by all who shared birds and photography with him, and as one who willingly gave his knowledge and enthusiasm with a great sense of humour.

He is survived by his wife Dorothy, daughter Margaret and sons, Robin and David – the latter no mean wildlife photographer.

Alan Parker

ALAN HENRY NORKETT, 1915-1990

Alan Norkett, who died in January 1990, was for several years an active member of the Society's Bookham Common Survey Team. He joined the L.N.H.S. in 1946 and began to investigate the freshwater algae on Bookham Common. He was interested in the seasonal changes that occurred in the algal communities of its ponds, both permanent, *i.e.* water-filled all year round, and temporary, *i.e.* those that tended to dry out in summer. Included in the latter category were not only the small, natural ponds, but also those that were man-made, *e.g.* the bomb-craters, gun-pits and slit-trenches which were legacies from the war years and all of which held water for variable lengths of time. It was during this study that he turned up two algae, namely *Bulbochaete nana* Wittr. (*Lond. Nat.* **26:** 81 (1947)) and *Palmodictyon viride* Kutz. (*Lond. Nat.* **27:** 49 (1948)) which were both new records for Surrey. Furthermore, in July 1948, he had the unexpected privilege of discovering a fungus, *Aegerita alba* (Preuss) Sacc., which proved to be a species new to the British list, growing on decaying bramble leaves in Gun-Pit 'A' pond (*Lond. Nat.* **28:** 50 (1949)). His algal work for the Survey terminated with a paper entitled 'Some preliminary remarks and list of the algae found on Eastern Plain, Bookham, 1947-1948' (*Lond. Nat.* **28:** 56-59 (1949)). In 1950 he turned his attention to the woodland bryophyte and lichen associations in Eastern Wood (*Lond. Nat.* **30:** 41 (1951)) and later assisted Mr J. R. Laundon with a lichen survey of oak trunks (*Lond. Nat.* **33:** 23 (1954)).

Norkett's career began in December 1933 on joining the staff of the Botany Department at the Natural History Museum, London, where he soon acquired a broad working knowledge of the different groups of non-flowering plants. On his return from war service in 1945 he was made responsible for both the curation and enquiries relating to the whole of the bryophytes, algae and lichens. This continued for some time until additional staff were appointed to take over the last two mentioned groups. He was then able to concentrate on the bryophytes alone and over the years developed specialist knowledge of the bryoflora of India. In his study he liaised with workers in that subcontinent, especially in the genus *Fissidens*, which was of considerable interest to him.

He joined the British Bryological Society in 1948 and became curator of its collections the same year, a post he held until 1969. In addition, he assisted the Secretary, E. C. Wallace, from 1950-58 with the yearly distribution of exchange packets of bryophytes amongst the Society's members, from his home first at

Fetcham then later at Great Bookham. From 1951 he also acted for many years as Referee for the Fissidentaceae and published a number of short papers on *Fissidens*.

Alan Norkett was both an active field-man and an indefatigable collector, not only in this country, but also abroad. It was during the B.B.S. Excursion held at Totnes, Devon in April 1950 that he added *Fissidens monguilloni* Thér to the British list (*Trans. Br. bryol. Soc.* **1** (5): 499, 518 (1951)). His several expeditions overseas considerably enhanced the Museum's holdings of Asiatic bryophytes. In 1961-62 he participated with one of us (K.H.H.) and others in the Museum's seven-month expedition to East Nepal for which he had been its prime mover in obtaining approval. His collections during that expedition amounted to more than 5,000 specimens, over 75 percent of which were bryophytes and lichens obtained at altitudes from 1,000-12,000 feet, and ranging over moist rice-terraces, evergreen oak forests, rhododendron forests and steep riverine cliffs.

He was to visit India on three further occasions before turning to Africa, where, during the winter of 1973-4, he collected in the Seychelles, principally on Mahé, Praslin, Silhouette and St Anne. Because the moss flora of these islands had not before been systematically investigated, it was perhaps the most fruitful of the major expeditions, though his last on behalf of the Museum. Although it is to be regretted that his *magnum opus*, a monograph on *Fissidens* for the whole of S.E. Asia, was not completed before he retired in 1975, his large Seychelles collection will continue to be studied for a long time to come, adding measurably to our knowledge of island bryology. A new species from this excellent material, *Calymperes norkettii* L. T. Ellis (Musci: Calymperaceae), has recently been described and named in his honour (*J. Bryol.* **15:** 733-735 (1990)), but unfortunately he died before seeing it in print.

At the time of his death he was living at Folkestone, Kent.

Eric W. Groves and Keith H. Hyatt

JOHN HENRY SAND, 1917-1990

News of the death of John Sand on 27 October 1990, after a short illness, was received with great sadness in the Society. An accountant of wide experience, John had served as Treasurer from 1982 to 1987, and thereafter as Chairman of the Administration and Finance Committee until his death. The responsibility for guiding the financial affairs of our large Society had been undertaken throughout with quiet efficiency and a high degree of professionalism. As a caring environmentalist and an enthusiastic ornithologist, John Sand was well-known in the field, his readiness to set foot in the wilder places of Britain and Europe making no concessions to his advancing years.

John returned to England in 1976 after a career with the Commonwealth Development Corporation in posts which he held with distinction following war service, latterly travelling and working in many parts of the Commonwealth. In Nigeria, Jamaica, Fiji, Hong Kong and Zimbabwe (then Southern Rhodesia), John's ability to relate and communicate ensured his wide acceptance as both friend and counsellor. His concern for the needy of many races and creeds found regular expression in later years by generous support of Amnesty International and other causes.

Living alone, John greatly valued the warm regard in which he was held by his cousin Mrs Beatrice Thornton and her family, to all of whom we extend our condolences on the loss of an esteemed mentor and friend.

C. B. Ashby

OLIVE LILIAN CASSIE, 1920-1991

It was a very sad moment for the Society when we learned of the death of Olive Cassie on the 26 February 1991 after a long fight against cancer.

Olive was born on the 10 April 1920 at Fulham in south-west London. After showing herself to be a very bright pupil at Godolphin and Latimer Girls' School she started work as a telephonist for the Post Office. She then moved on to become a telephonist for London Transport at their Chiswick Works, then at Acton Works and finally to London Transport Headquarters at St James's as supervisor of all the L.T.E. telephonists until her retirement in 1980.

Olive met her husband Peter in 1950 when they were both working at the L.T.E. Chiswick Works and they were married on the 17 November 1951. They joined the L.N.H.S. in 1968 and Olive was subsequently to become the Secretary of the Ornithology Section. Peter became the Section's Field Meetings Secretary and they both spent over 10 years in their respective roles in which their hard work and dedication were very much appreciated. Olive had a love of birds and of natural history generally, but her first love was flowers. She was a member of several societies including the Royal Horticultural Society and the Alpine Garden Society. Along with Peter she used to visit many gardens and flower shows and was a regular visitor to The Chelsea Flower Show and the various Alpine Garden Society shows.

Both Olive and Peter travelled worldwide in search of flowers and birds and visited such places as Ethiopia, The Gambia, Tunisia, Turkey, Greece, Crete and Thailand. As a result of their membership of the L.N.H.S. and their regular trips abroad, Olive and Peter made a great many friends. Olive will be missed greatly by the Society and by all who knew her. We extend our heartfelt sympathy to Peter.

ROGER HARBIRD

JOHN G. CHIPPERFIELD, 1934-1990

John Chipperfield joined the Society in 1955 and for most of the following twenty years was an active participant in the affairs of the Ornithology Section, regularly attending indoor and field meetings, and making a special study of the birdlife of the Roding Valley. A popular and experienced leader in the field, John Chipperfield will be remembered also for his many contributions to the Society's administration, serving at various times as Reading Circles Secretary, member of Ornithology Committee, Council Representative and, in 1961 and 1969, assisting in the production of the *London Bird Report*. Although in 1975 he moved to Huntingdon, and later to Norfolk, his membership of the L.N.H.S. continued until his death.

The Council of the Society has gratefully accepted the bequest of various assets, including John's extensive library, and many ornithological books have as a result been added to our collection at Imperial College.

C. B. ASHBY

PETER JAMES GRANT, 1943-1990

The whole ornithological world was shocked to hear that Peter Grant had terminal abdominal cancer, of which he died on 16 April 1990, aged 46. It still seems quite unbelievable that his cheerful voice will no longer answer the phone, that there will be no more evenings poring over photos of gulls and waders, and that there will be no more crack-of-dawn starts to visit Dungeness with Peter, whose enthusiasm for birds seemed boundless. And there will be many who share this sense of loss, for there can be few in British ornithology whose circle of friends was as large as Peter's. Many a young birder (and more than a few older ones) have been lifted by his interest and encouragement. All will have their own fond personal memories.

Peter's birding started in his school days in the 1950s, haunting Beddington Sewage Farm in south London. A frequent companion was Bob Scott, who in due course became warden at Dungeness. It was natural, therefore, that Peter should also gravitate to 'Dunge', where he continued birding with Bob Scott, sharpening his identification skills and developing his interest in bird identification problems.

At Dungeness there were seabirds to be watched, particularly those feeding at 'The Patch', that upwelling of cooling-water from the nuclear power station that attracts diving terns and scavenging gulls. This period in Peter's career gave rise to a number of identification papers written jointly with Bob Scott in *British Birds* (which had published his first 'Note' – 'Jackdaws collecting hair from live deer' – in 1956). Perhaps the two most notable of these papers were on the identification of immature Mediterranean gulls, and the identification of juvenile common, arctic and roseate terns.

In the early 1970s, Peter teamed up with Jeffery Harrison to monitor the changing bird-life of the Thames as the various attempts to clean up the river took effect. Regular monthly trips along the Thames in a police launch provided data that were later incorporated in *The Thames Transformed* (reviewed in *Br. Birds* **70:** 125), telling the ornithological story of the clean-up. Jeffery's and Peter's further plans to make a study of the birds of Romney Marsh were brought to a halt by Jeffery Harrison's untimely death in 1978.

Peter's association with Bob Scott, together with his rapidly developing identification skills, brought him into the London Natural History Society, where he was soon actively involved on their Records Committee, and as editor of the *London Bird Report* (**34-36,** for 1968-70). By the mid-1970s, Peter had a worldwide reputation for his identification skills, having in 1971 been elected a member of the *British Birds* Rarities Committee. In 1976, he became the Committee's chairman, remaining so until 1986. In 1979, he became a member of the Editorial Board of *British Birds,* to which he contributed enthusiastically and influentially until his resignation in 1987.

For a number of years Peter was a representative for Johnson's Wax. He was a good organiser, and this made him both good at his job, and enabled him to organise his time to allow regular visits to Dungeness. When he was made redundant, he was scarcely able to contain his delight, and indeed, he made little attempt to do so. This was the opportunity to become a freelance ornithologist, an opportunity he seized with his usual enthusiasm. Thereafter, the birding had to pay the bills.

His interest in gulls and terns eventually culminated in a major series of papers on the identification and ageing of gulls, this time by Peter alone, in *British Birds.* These papers he developed into the very successful book *Gulls – a Guide to Identification,* published by Poyser. In this area, Peter's influence was overwhelming. First the papers, then the book, encouraged many to look again at gulls, at the time a neglected group of species, drawing attention to the importance of moult sequences and how to use this knowledge to decide the age of the bird. *Gulls* set – and continues to set in the now revised second edition – new standards, as both one of the first identification guides covering just one group of species, and also as an example of how such a guide should be written and illustrated.

Peter's talent for bird illustration was put to good use in *Gulls,* which is illustrated by delightful black-and-white line drawings of extreme technical accuracy. He excelled in this medium, and many of his little vignettes, often portraying warblers, grace the pages of *British Birds,* particularly in the 1970s.

His contributions to bird identification did not stop with gulls and terns. He had a considerable interest in passerines, particularly pipits and warblers, and made notable contributions to the understanding of the identification of *Acrocephalus* and *Hippolais* warblers, and tawny and Richard's pipits. Many will remember the 1979 'Blyth's reed warbler' in Scilly, watched by over 500 people, which only Peter correctly identified as a marsh warbler. And mention must be made, too, of his enthusiasm for waders, particularly stint identification, which culminated in the very influential paper on that subject, written jointly with Lars Jonsson, using Lars' superb illustrations that Peter so much admired.

Peter's good humour, patience and organisational ability made him a popular and successful tour leader. In 1982, he had become a director of Sunbird, where he helped to pioneer the 'Sunbirder' holdays: groups of birders sharing a package holiday, either accompanying the tour leaders during the day, or 'doing their own thing', but meeting up for a roll-call of the day's birds in the evening. Peter's good humour came to the fore on these occasions. All those who heard him describe how to eat a falafel – a Middle-Eastern snack – choosing the best shop, stuffing the pitta bread solid with salad, adding garnish (careful with the hot one), then how to eat it without getting it all down your shirt, will never forget what great fun a roll-call with Peter was.

His interest in, and enthusiasm for identification continued undiminished until the end. For the last two or three years he was identification consultant to *Birding World*, bringing to that magazine too his many talents that will be so sadly missed. His major final contribution (with Killian Mullarney) was a series of articles in *Birding World*, now reprinted as a small booklet, *The New Approach to Bird Identification*. If you have not already read it, do so now. It encapsulates the experience and philosophy of one of the masters of bird identification.

The birding world will miss Peter, and all will wish to extend their deepest sympathy to his wife Denise, and to his children, Suzanne and James.

RICHARD CHANDLER

We are indebted to the Editor of *British Birds* for allowing us to reproduce the above which appeared in Volume 83, November 1990. Ed.

London Natural History Society Income and Expenditure Account for the year ended 30 June 1990

1989 £	Income	£	£	£
	Income from members and supporters:			
9,844	Subscriptions		9,278	
5	Entrance fees		—	
233	Donations		403	
580	Tax recovered on covenanted subscriptions		811	
10,662				10,492
1,676	**Sales:** Journals	814		
(140)	*Less:* Expenses	(74)		
			740	
179	Literature & surplus library stock		45	
24	Journal offprints		6	
144	*Flora of the London Area*	123		
(8)	*Less:* Expenses	(10)	113	
489	*Butterflies of the London Area*	288		
(488)	*Less:* Expenses	—		
			288	
1,876				1,192
	Income from investments and deposits:			
12,831	Stocks and shares		14,063	
3,134	Tax recoverable 1989/90	3,700		
806	1990/91	829		
			4,529	
269	Investment cash account		649	
340	Profit on sale of investments		6,766	
			26,007	
(3,080)	*Less:* Custodian's charges	(3,194)		
(23)	Overseas charges	(21)		
			(3,215)	
			22,792	
112	Charities Deposit Fund		82	
17	Bank deposit account		2	
14,406				22,876
26,944	**Total Income**			34,560
(27,871)	*Less:* **Expenditure**			(26,158)
(927)				8,402
(7,326)	*Less:* Provision for loss on stock of *Butterfly Atlas*	—		
8,650	*Less/(Add):* Provision for diminution in value of certain investments	(3,137)		
1,324				(3,137)
£ 397	Surplus for the year			£ 5,265

1989 £	1989 £	Expenditure	£	£
		Meeting costs, sectional & general expenditure:		
	1,813	Hire of halls and rooms	2,209	
	1,700	Lecturers' fees and expenses, sectional expenses etc.	1,468	
	210	Postage and telephone	193	
	117	Stationery	115	
	1,206	Services (Auditors' fees, insurance, etc.)	1,285	
	700	Honoraria and expense allowances	700	
	26	Equipment repairs and renewals	—	
	3,285	Depreciation	1,860	
9,057				7,830
		Publications		
		Printing and expenses:		
	6,046	*London Naturalist* **67**	5,786	
	6,135	*London Bird Report* **52**	4,290	
	12,181		10,076	
	1,185	*Programme*	1,060	
	2,157	*Bulletin* and *Newsletter*	2,593	
	2,295	Mailing	2,011	
17,818				15,740
874		Library		1,138
16		Publicity		814
106		Grants, including contributions to other organisations		636
£27,871		Total expenditure for the year		£26,158

Balance Sheet as at 30 June 1990

1989 £	£		£	£
		Fixed Assets acquired after 30 June 1985, excluding library books:		
	10,342	Computers, including ancillary equipment and initial programming costs	10,342	
	143	Library equipment	143	
	1,415	Other indoor equipment	1,415	
	413	Bat detectors	413	
	2,158	Bookham hut	2,158	
	14,471		14,471	
3,444	(11,027)	*Less:* Depreciation	(12,887)	1,584
	14,928	Unsold copies of *Butterfly Atlas* at cost, including cost of complimentary copies	–	
–	(14,928)	*Less:* Provision	–	
	206,046	*Quoted Investments* at cost	217,958	
	(4,197)	*Less:* Provision	(7,334)	
201,849				210,624
		(Market Value £336,447 – 1989: £324,926)		
		Current Assets		
		Funds at bank and on deposit;		
	6,030	National Westminster Bank PLC	4,451	
	100	Charities Deposit Fund	1,550	
	6,130		6,001	
	233	Cash in hand	236	
	200	Payments in advance and other debtors	147	
	2,636	Tax recoverable on investment income	829	
	375	Stationery stocks	325	
9,574				7,538
		Less: Current Liabilities		
	(25)	Contributions to bat boxes	(25)	
	(1,440)	General liabilities and accrued expenditure	(1,054)	
(1,465)				(1,079)
£213,402		Total net assets		£218,667
		Representing: *General Fund* (incorporating the Hindson and Castell Bequests)		
213,005		Balance at 30 June 1989		213,402
397		Surplus/(Deficit) for the year		5,265
£213,402				£218,667

C. B. ASHBY President
C. M. BALFOUR Treasurer
Dated: 29 November 1990

Report of the Auditors to the Members of the London Natural History Society

We have audited the financial statements in accordance with auditing standards.

In our opinion these statements give a true and fair view of the income and expenditure of the Society for the year ended 30 June 1990 and of its assets, liabilities and fund balances at that date.

4 London Wall Buildings
LONDON EC2M 5NT
28 November 1990

FRASER & RUSSELL
Chartered Accountants

Note to the Accounts

Accounting Policies

a) Subscriptions, which are collected on a calendar basis, continue to be brought in as received. No account is taken of subscriptions in arrears until received.

b) Investment Income is credited to the Income and Expenditure Account together with the income tax credit receivable.

c) Provision is made for all material debtors, prepayments, creditors and accruals with the exception of subscription income (see note a above).

d) Depreciation is provided on fixed assets at rates calculated to write off the cost of each asset over its expected useful life as follows:–

Computer Equipment	—	25%
Other Equipment	—	20%

See also the Treasurer's Notes on page 7.

Book Reviews

Nature's Wild Harvest. By Eric Soothill and Michael J. Thomas. Blandford Press, London. 1990. 160 pp. Line drawings by Vanessa Luff and four photographic colour plates by Eric Soothill. £7.95. ISBN 0 7137 2226 6.

Here is another book for those of us who like to combine a new gastronomic experience with the pleasure of getting something for nothing. The countryside is a comparatively unexploited cornucopia, and *Nature's Wild Harvest* draws our attention to the many edible fungi, fruits, flowers, leaves, seaweeds and shellfish that are there for the taking. On a desert island such a book would be indispensable. While not essential in 20th century Britain, it can do much to cheer our sometimes jaded palates, and make a welcome change from supermarket food, without putting a strain on the purse. An Autolycus by nature, I was converted years ago.

After an Introduction, which includes general hints on making jams, jellies and wines, the authors present their material under four headings, 'Spring', 'Early Summer', 'Late Summer' and 'Autumn'. Flowering plants and fungi are considered in each of these sections, but the molluscs are not dealt with until the 'Autumn' chapter. Scientific names are explained and the derivation of vernacular plant names is given in many cases. The species are described in great detail, with notes on their habitat, and there is information on the biology of the molluscs. The medicinal value, real and alleged, of many of the plants is mentioned, but detailed prescriptions are not provided. I have therefore been unable to confirm whether yarrow really is 'a good hair restorer'. There are other interesting snippets of information. I did not know, for example, that in Sweden cranberries are used for cleaning the silver.

Comparison with Richard Mabey's *Food for Free*, is, of course, inevitable. *Nature's Wild Harvest* covers much the same ground, and in places even the wording is similar to Mabey's. One has the impression, however, that whereas Mabey is usually writing from personal experience, Soothill and Thomas have based their text mainly on hearsay and academic research. Mabey has relatively little to say about wines, but this new book has recipes for 23 wines, as well as for sloe gin, two kinds of beer and three liqueurs. This means that several plants are included which do not feature in *Food for Free, e.g.* coltsfoot, gorse and honeysuckle. I am glad to find that two allegedly palatable plants recommended by Mabey, chickweed and cleavers, have been excluded. I once tried cooking and eating these during a period of financial crisis and decided they were better left for less discriminating herbivores.

Vanessa Luff's drawings are of mixed quality. Most of them are adequate, some are very good. Others, however, are less satisfactory, notably those of cow parsley, meadowsweet, woodruff and tansy. Marjorie Blamey's marginal drawings in *Food for Free* are superior without exception, in spite of being much smaller. Each of the four colour plates is a collection of photographs with 17 small panels superimposed on a large close-up. May blossom provides the background for 'Spring', wild raspberry for 'Early Summer', beech mast for 'Late Summer' and sweet chestnut for 'Autumn'. It is not altogether a happy arrangement, for some of the inset photographs are too small to be of much help in identification. The burdock illustrated appears to be the commoner *Arctium minus* rather than *A. lappa* as is claimed, and what purports to be heather *Calluna vulgaris* (growing with bilberry) is obviously bell heather *Erica cinerea*.

There are a few peculiarly worded statements. Having correctly said that salad burnet is lime-loving, why precede the comment that it is 'also especially fond of chalky districts' with a 'but'? Is not chalk a kind of limestone? Wild strawberry, another plant of base-rich soils, is said to be sand-loving, and the same claim is made for stinging nettle and hemlock. There are some spelling errors: 'radicle leaves' (p.14), 'pinnatified' (p.121) and 'sooth' for 'soothe' (p.125). And the plural of 'honey' is not 'honies' (p.81).

Harvesting the wild is not without its hazards, and the authors could, perhaps have done more to draw attention to the existence of poisonous plants that may resemble edible species. The possibility of mistaking hemlock for cow parsley is mentioned, but not the risk of eating other toxic umbellifers. We are warned that the berries of deadly nightshade have been taken for bilberries, and that they should not be confused with blackberries! Anyone unfamiliar with a blackberry would, in my opinion, be ill-advised to try *anything* in this book, especially some of the fungi. Here extra care is needed. The authors caution the reader to beware of yellow-staining mushrooms, but they do not mention the deadly false morel *Gyromitra esculenta* when dealing with the edible species. And it is not true to say that boleti with pinkish or reddish stems are merely unpalatable. Three species are poisonous, one of them possibly lethal, and there are others that can cause stomach upsets.

Instructions for drying fungi for future use are given, but no mention is made of the fact that many of them, including the giant puffball, can also be kept in the freezer. The same, of course, applies to wild fruits. Breakfast for me just would not be the same without last season's blackberries.

W. G. TEAGLE

Nature Conservation in Hounslow. By David Pape. London Ecology Unit. Ecology Handbook 15. 1990. A4, 76 pp. £4 at major bookshops, or direct from the L.E.U., Bedford House, 125 Camden High Street, London NW1 7JR at £5.50 post free. ISBN 1-871045-11-8.

Nature Conservation in Hounslow is number 15 in the series 'A Nature Conservation Strategy for London'. The introduction tells us that the purpose of this strategy is to promote planning for wildlife and its enjoyment throughout the Capital. It is further intended to help to ensure that account is taken of nature conservation in any planning and planning decisions and to be a basis for the preparation and implementation of management plans for individual sites, and to increase public awareness and participation by providing information in a readable format. This information includes a section devoted to location and physical features comprising geographical detail such as roads, railways, river systems and geological formation, the last also illustrated in a four-colour topographical map and in a schematic plan featuring major geological strata. Both this section and the section entitled 'History of Land Usage' are of general interest.

Another section on 'Habitat' incorporates a map of wildlife habitats which is useful as it is extended to include those outside the Hounslow Borough boundary, but close enough for inclusion in any visits to some of the sites within the borough. 'Land Status', 'Conservation Initiative' and 'Conservation Organizations' are all dealt with as a further section. Nature conservation sites that are of importance within the borough are fully described and are also located in a coloured plan, whilst areas where there is little or no local provision for observing wildlife are also identified in the same plan.

The sites of conservation value are categorized into those of Metropolitan Importance, Borough Importance and Local Importance, each individual site having been given a very comprehensive decription as to situation, habitats contained within, a summary of the natural history content and other relevant information. It would have assisted in the locating of these sites if the background detail in the small map at the head of each description had been printed more clearly, though map references are also given.

Twelve pages of attractive, coloured photographs featuring various of the sites covered by the text, together with a further map, this time showing the green corridors within the borough, all serve to enhance this handbook. It contains a great deal of information and in my opinion would be of both interest and practical use to anyone who gains pleasure from natural history or who is concerned with conservation within the London Borough of Hounslow, whether they be a resident or a visitor.

P. A. Williams

The Restless Kingdom. An Exploration of Animal Movement. By John Cooke. Blandford (Cassell), London. 1991. 198 pp. £18.95. ISBN 0 7137 2292 4.

John Cooke is well qualified to write on such a vast topic as animal movement. As well as being a respected arachnologist, he is a former director of Oxford Scientific Films, a former curator at the American Museum of Natural History, and he has written widely on invertebrates.

Animal movement is a subject which normally tends to be covered by specialists investigating their own particular groups, with the results published in specialist scientific journals. This book is different. It is a superbly produced natural history. It is 'a journey of exploration through the animal kingdom examining the ways in which animals move. As such it is broadly scientific, but it is not a textbook and it is not comprehensive. It is meant to be read for pleasure as well as enlightenment...'. Those are the author's own words. It has been both a pleasure and an enlightenment to read the book and this has been made all the more enjoyable by the selection of 170 superb colour photographs, many of which are full-page size or width in this larger than A4 production.

The main chapters are 'Background Biology', 'The Mechanics of Locomotion', 'Locomotion in Water', 'Locomotion on Land, and 'Flight'. The text describes the biology and physics of each group in a very readable, but scientifically accurate, way and the captions to the photographs detail the actual processes of the animal illustrated. Line drawings of typical examples are used to illustrate diagramatically the mechanics of topics such as flight, walking and swimming.

K. H. Hyatt

As we go to press we have received notice of the pending publication of another Blandford title, *Encyclopedia of Marine Animals*, by Dr Neville Coleman, with 1,000 colour photographs in 352 pages. £25. ISBN 0 7137 2289 4. Ed.

The Moths and Butterflies of Great Britain and Ireland Vol. 7, part 2: *(Lasiocampidae – Thyatiridae).* Edited by A. Maitland Emmet and John Heath. Harley Books, Colchester, 1991. 400 pp. 8 col. pls., 8 text figs., 28 maps. £49.50 increasing to £55 on 1 January 1992. ISBN 0 946589 26 7.

Those who know their Lepidoptera checklist will be wondering how the publisher can possibly justify a book costing fifty quid for an account of only thirty-one species of moths. The answer to this lies in the knowledge that hiving off the butterflies into a separate volume (volume 7, part 1) left the publisher room to add extra introductory chapters. So, do these justify the price ticket, or was the split into two volumes just a publisher's money-spinner? (The species accounts themselves require no comment, as they are of the usual exemplary standard one has come to expect from this series).

It is not the reviewer's task to speculate on the real truth of the matter; however, I can say that the three introductory chapters, 'Classification of the Lepidoptera', 'Resting postures in the Lepidoptera' and Maitland Emmet's 243-page 'Chart showing life history and habits of the British Lepidoptera' certainly do warrant the fifty pound label. Whilst not in any way belittling the value of the first two mentioned chapters it is Col. Emmet's *magnum opus* of a contribution which really makes this volume of interest. Each one of our 2,500 butterflies and moths, both macro and micro, is listed here in columnar format. We are informed, through the use of abbreviations (repeated on a handy, laminated card for easy reference), which stage of its life history the insect is at in each month of the year, where each stage is to be found and what it is doing *(e.g.* in a case, mining, forming a gall, in a web, under ground, etc.), the status of the species in the British Isles, its distribution in the same area, the habitats in which it is to be found, the flight times of the adult, the foodplants, number of generations per year, conservation status and other remarks. This truly is the most thorough, well researched piece of work on the British Lepidoptera that I have ever encountered and I have already found it immensely useful myself in analysing species lists for conservation sites. It is a pity that only the conservation status of species included in the Insect Red Data Book (Shirt, 1987) is given in the chart. The nationally notable categories Na and Nb given by Ball (1986) would have been a valuable addition and would have made the list much more usable by ecologists with no knowledge of the Lepidoptera. The chart, and hence the book, will nevertheless be of immense interest and value to ecologists, land managers, collectors and others.

The long delay between publication of the separate volumes of this series has been a constant source of criticism and I am slightly bemused by the presence of the late John Heath's name on the cover as joint Editor; after all, he died in 1987 and volume 7, part 1, (reviewed in *Lond. Nat.* **69**: 108), was dedicated to his memory. The present volume's delay has seen the death of one of the principal authors to the text of the series, Russell Bretherton, and it is to his memory that the present volume is dedicated. However, that having been said, it seems quite fair to accept that the horrendous task of proof-reading the life-history chart, the publisher's excuse for the delay, was entirely justified; I have tried, but utterly failed, to detect even one error!

Apart from a few minor irritations, which include constant reference to the Systematics Association as the 'Systematic Association', this is an excellent work, thoroughly recommended to all who are in any way involved with British Lepidoptera.

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BALL, S. G. 1986. *Terrestrial and Freshwater Invertebrates with Red Data Book, Notable or Habitat Indicator Status.* Invertebrate Site Register Report Number 66. Nature Conservancy Council, Peterborough.

SHIRT, D. B. 1987. *British Red Data Books: 2. Insects.* Nature Conservancy Council, Peterborough.

COLIN W. PLANT

Small Wonder. A New Approach to Understanding Nature. By Mari Friend. Blandford (Cassell), London. 1991. 160 pp. Many illustrations in colour and black and white. £14.95. ISBN 0-7137-2202-9.

This is a most delightful book and it is written in a most relaxed and pleasing way. It is an ecology book for everyone, adults and children alike. I have enjoyed reading it and later turning the pages at random. I have learnt a lot from it and I have also been reacquainted with many other things that one tends to 'lose' over the years. The life-cycles and courtship of the many groups of aquatic animals are especially interesting. It is written mainly with families in mind: adults who are interested in natural history should be able to teach their children as they go along. The many illustrations – all by the author – are essentially accurate and in most cases the species are readily recognizable, but some, especially the mammals and birds, are rather 'twee', whilst a few others are bordering on caricatures. Only a few I found hard to convince myself of. The book contains a number of anecdotes – I liked the one about the mole that the author befriended. Some species are illsutrated more than once, *e.g.* the painted lady on thistle and later on nettle (both its larval foodplant, but in different sections of the book) and the red admiral several times, including on blackberries in the autumn, as a species which lays its eggs on nettle leaves, and as a migrant seen arriving in coastal areas, whilst also shown at nettles is the formerly introduced European map butterfly which seemed rather out of place in the book.

Most people when beginning the study of natural history soon appreciate the meaning of the term 'family', and throughout most of the book it is used correctly. However, on page 121 we are told that 'Pseudoscorpions and red soil mites are in the spider family' – oh dear! On an earlier page the larvae of water-mites are correctly described as parasitic, whilst insects with 'red mites' on them are referred to, but, alas, the 'dor bettle that was completely infested by red mites' wasn't! Many vernacular names in natural history have accepted uses and that paragraph could have been written at the same length and correctly, without being at all too specialized. Many popular books of high quality like the present one can contain statements which are not precise and which mean that the student will have to un-learn certain things at a later date. My personal view is that editors try to adapt the texts to suit their own styles and formats and in so doing unwittingly alter the meaning or distort the accuracy. The final text of all such books should be read by specialists from the disciplines covered and many of these inaccuracies would be avoided, although it hardly needs a specialist to condemn the statement that 'There is no distinct division between butterflies and moths, except that butterflies fly by day'.

The book covers the following topics: 'Networks in Action', which deals with decomposition, food-chains and food-webs, 'Flowers and Insects: Interaction', 'Gardening for Wildlife', 'Natural Builders', 'Freshwater Wonders', 'Life in a Field', 'Hedgerow Ecology', 'Woodland World', 'Winter Survival' and 'Beachcombing'. It full of practical ideas for teaching and learning and does the author credit. I recommend it as essential reading for all naturalists, especially if in recent years one has been specializing in a serious study and has 'forgotten' the more general knowledge. The end-papers are miniature wallcharts and with the attractive dust-jacket enhance the book.

K. H. Hyatt

Madam Dragonfly. The Life and Times of Cynthia Longfield. By Jane Hayter-Hames. Pentland Press, Durham. 1991. 208 pp. £15.95. ISBN 1 872795 20 X.

Those of us who knew Cynthia Longfield personally have been eagerly looking forward to the appearance of this book. The author is Cynthia's great niece and she has done a very thorough job in the quest for information, although as she says in the introduction, 'I am not qualified to do justice to her work in entomology and I hope that her colleagues in science will accept this book as a general account of an interesting life and will perhaps provide a truly scientific biography of Cynthia in due course'. That is true, but being a relation the author has been able to tell us much that others would not have been able to describe. Hopefully Cynthia Longfield's full contribution to science will one day be written and the present volume will greatly assist in its compilation.

Cynthia was the youngest of three daughters of Montifort and Alice Longfield. Her father came from Castle Mary, Cloyne, Co. Cork and it was to here that she was eventually to retire in 1957 and where she spent the rest of her life. Sadly she died at the age of 95, just 20 days before this book was published. Cynthia's inquisitive interest in natural history began long before she reached her teens and by the age of 14 she wanted books so that should could satisfy her desire to teach herself, first from children's natural history books, then 'more adult reading', such as Gosse, Lyell and T. H. Huxley. She soon became capable of fieldwork – a vocation that stayed with her throughout her working life. She also became a close adherent of Darwinism and in December 1921 she set off for South America. In 1923 Cynthia travelled in Egypt and already entomology was her chief interest. In 1924 she joined the 'St George' Expedition to the South Sea Islands and amongst those aboard were two other eminent entomologists, Evelyn Cheeseman and Cyril Collenette. It was not long after returning from the 'St George' Expedition in the late summer of 1925 that Cynthia started working on an unsalaried basis in the Entomology Department at the Natural History Museum and here she worked 'full-time' until her retirement. She had become a world authority on the dragonflies and had established herself as a professional entomologist of the highest order.

In 1932 Cynthia became the first lady President of the London Natural History Society, and she was deeply involved in both the Entomology and Ornithology Sections and was one of the Society's most active members – when she was not abroad on more expeditions. In 1934 she journeyed alone to Africa, but on her return she settled down at the Natural History Museum with two main areas of research, her African collections and, fortunately for the naturalists of this country, the work which culminated with the publication in 1937 of the first edition of 'The Dragonflies of the British Isles', still one of the most sought after works.

During the First World War Cynthia initially joined the then Army Service Corps as a driver, but later transferred to an aeroplane factory in the Fulham Road, where 'at first she was in charge of the glue pot'. Then she graduated to carpentry. Before the Second World War, but when the atmosphere was such that war was inevitable, Cynthia joined the Auxiliary Fire Service in London and was soon driving senior fire officers in requisitioned taxis. At the first training exercise she helped Herbert Morrison on with his fire boots. When the Museum's Botany Department was bombed, Cynthia was instrumental in seeing that a turntable ladder was used to fight the fire raging in the east wing. Cyril Collenette wrote that 'her prompt action probably saved the whole Museum from destruction'.

After the war Cynthia renewed her entomological activities in earnest. By 1945 'The Dragonflies of the British Isles' was out of print, so she worked on an enlarged, updated edition with new plates. This was even more successful than its predecessor. After the war international congresses again began to be held and Cynthia Longfield participated in numbers of them, including after her retirement to Ireland. At the age of 73 she flew to Moscow where she remarked that 'Moscow was practically being run by women, driving all the buses, trains and taxis, a few men were in charge, all the rest were women'.

Inevitably there are a number of minor criticisms. The first thing which struck me when I opened the book was the large, 12-point, print size of the main text, so imagine my surprise when I turned to the verso of the title-page to read 'Typeset in 10pt Times'. This in fact relates only to the preliminaries, the two bibliographies and the index. Page 48 of the review copy has some words missing from the last line. There are a few errors of statement, for instance the Natural History Museum has never been the British Museum of Natural History and the Geological Museum was never a department of the British Museum, whilst Cloyne is east of Cork, not west. There are also several spelling and other typographical errors and inconsistencies, and perhaps I can be forgiven for spotting one or two slips relating to the Natural History Museum.

However, these are minor blemishes. It has been a great pleasure to read of the life of such a noteworthy naturalist and fellow L.N.H.S. member, and it has been hard not to quote more from the book. The narratives of Cynthia's travels and her times have been fascinating to read and we give the author our thanks for so thoroughly accomplishing the task.

K. H. Hyatt

The London Naturalist

Instructions to contributors

Submission of papers

Papers relevant to the natural history and archaeology of the London Area should be submitted to the editor, Mr K. H. Hyatt, c/o Department of Zoology, British Museum (Natural History), Cromwell Road, London SW7 5BD, before the end of January if they are to be considered for publication in the same year. However, the editor will be pleased to be contacted at any time to discuss possible contributions. Manuscripts should be typed, with double spacing and wide (three cm) margins, on one side of the paper only. Authors must retain a duplicate copy. Papers should include at the beginning an abstract, summary, or synopsis. Sheets must be numbered.

Text

Locality spellings should follow the latest editions of the maps published by the Ordnance Survey. Capitalization should be kept to a minimum. Common names of animals and plants must begin with lower-case initials, and Latin names of genera and species must be underlined. When both common and Latin names are given there should be no brackets or commas separating them. Genus names should appear in full where first used within each paragraph. When scientific names are taken from a standard work, which must be cited, authorities should be omitted. In descriptive matter numbers under 10 should be in words, except in a strictly numerical context. Dates in the text should follow the logical sequence of day, month, year, i.e. 25 December 1971, but in lists as 25.xii.1971. Measurements should be in metric and follow the SI system (Système International d'Unités), with imperial equivalents in parentheses where appropriate. There should be no full point following Dr, Mr, Mrs or St. Lists should be in systematic, alphabetical or numerical order. Hyphens should not appear at the ends of lines. Tables should be typed on separate sheets at the end of the text. **Word-processed text should not use italic, bold or compressed typeface.**

References

Reference citation should be based on the Madison rules (in *Bull. Torrey bot. Club* **22**: 130-132 (1895)), except that a colon should always precede a page number. Capitalization in titles of papers in journals should be kept to a minimum. Journal titles should follow the abbreviations in the *World List of Scientific Periodicals* and be underlined. Book titles should also be underlined. Examples are as follows:

In text:

Meadows (1970 : 80) or (Meadows 1970).

In references:

MEADOWS, B. S. 1970. Observations on the return of fishes to a polluted tributary of the River Thames 1964-9. *Lond. Nat.* **49**: 76-81.

MELLANBY, K. 1970. *Pesticides and Pollution*. Ed. 2. Collins, London.

WHITE, K. G. 1959. Dimsdale Hall moat, part II. *Trans. a. Rep. N. Staffs. Fld Club* **92**: 39-45.

Illustrations

Distribution maps should be submitted in the form of a Recording Map with symbols in Indian ink and stencilled or by transfers e.g. 'Letraset'. Solid dots are used to indicate contemporary or recent presence, circles for old records and crosses (not pluses) for other information, such as introduced species. The caption should be written outside the frame of the map and will be set up by the printer.

Line drawings should be in Indian ink on white card or tracing paper, larger than the printed size, but no larger than A4. Place names, etc., must be produced with stencils or Letraset. Captions should be separate as they will be set up by the printer, but keys that include special characters should be included within the borders of the figure.

Photographs should be glossy black-and-white prints, of good contrast, preferably plate or half-plate in size, or, following consultation with the editor, in the form of colour transparencies, either 35 mm or larger.

Proofs

Proofs will be sent to authors for scrutiny, but only essential corrections can be made at that stage.

Reprints

Up to 25 free reprints will be supplied on request. Additional copies may be purchased if ordered when the proofs are returned.

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